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Olof Hallonsten

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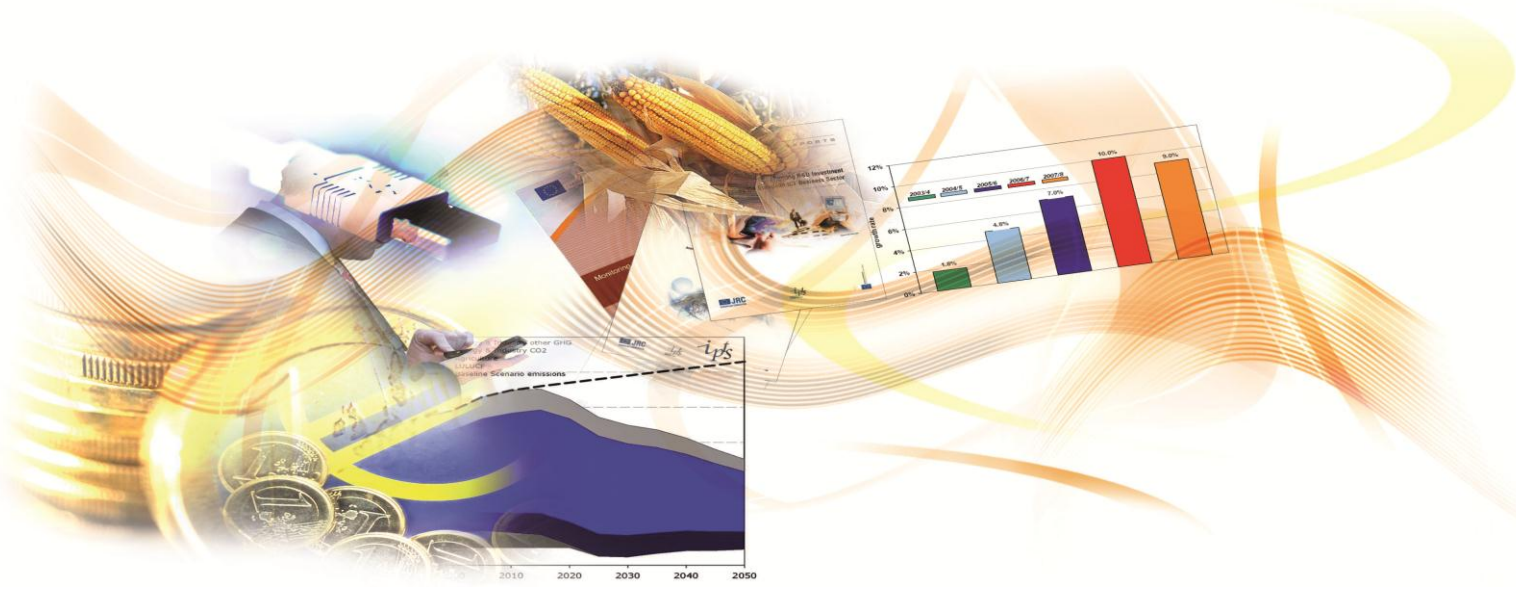

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Abstract

The Analytical Country Reports analyse and assess in a structured manner the evolution of the national policy research and innovation in the perspective of the wider EU strategy and goals, with a particular focus on the performance of the national research and innovation (R&I) system, their broader policy mix and governance. The 2013 edition of the Country Reports highlight national policy and system developments occurring since late 2012 and assess, through dedicated sections:

- national progress in addressing Research and Innovation system challenges;
- national progress in addressing the 5 ERA priorities;
- the progress at Member State level towards achieving the Innovation Union;
- the status and relevant features of Regional and/or National Research and Innovation Strategies on Smart Specialisation (RIS3);
- as far relevant, country Specific Research and Innovation (R&I) Recommendations.

Detailed annexes in tabular form provide access to country information in a concise and synthetic manner.
The reports were originally produced in December 2013, focusing on policy developments occurring over the preceding twelve months.

ACKNOWLEDGMENTS AND FURTHER INFORMATION

This analytical country report is one of a series of annual ERAWATCH reports produced for EU Member States and Countries Associated to the Seventh Framework Programme for Research of the European Union (FP7). ERAWATCH is a joint initiative of the European Commission's Directorate General for Research and Innovation and Joint Research Centre.

The Country Report 2013 builds on and updates the 2012 edition. The report identifies the structural challenges of the national research and innovation system and assesses the match between the national priorities and the structural challenges**,** highlighting the latest developments, their dynamics and impact in the overall national context.

The first draft of this report was produced in December 2013 and was focused on developments taking place in the previous twelve months. In particular, it has benefitted from the comments and suggestions of Jens Sörvik from JRC-IPTS. The contributions and comments from DG-RTD are also gratefully acknowledged.

The report is currently only published in electronic format and is available on the ERAWATCH website. Comments on this report are welcome and should be addressed to jrc-ipts-erawatch-helpdesk@ec.europa.eu.

EXECUTIVE SUMMARY

Sweden is among the highest ranked countries in the world in R&D investments as percentage of GDP (only surpassed by Finland and Israel) and is consequently well above EU average in this measure. Despite having managed the effects of the 2008-2012 economic crisis better than most EU countries and despite thorough efforts in the past few years to counter the negative trends, Swedish annual investment in R&D is in steady (relative) decline. The main reason for this is dropping private sector R&D expenditure. On the performer side, the private sector dominates, with around 60% of the total R&D investments, although a small number of very large companies account for the largest part of the private sector R&D activities. A strong academic sector consumes over 90% of the governmental appropriations for R&D and is thus responsible for most of the public R&D including not only basic research but also applied and strategic research programs for Swedish long-term competitiveness.

Governmental research and innovation policy is generally based on the analytical conclusion that while the research and innovation system is in relatively healthy shape, Swedish long-term competitiveness hinges on strategic profiling and mobilization in core areas and strengthening of the rather weak interaction between academia and industry. The two recent quadrennial research and innovation bills (2008 and 2012) have launched several measures in this direction. The launch of the so called Strategic Research Areas (2008), which meant generous and targeted funding for 20 areas chosen by the government, and the 2012 follow-up with similar funding to an additional four areas (including forestry, life science and sustainable development) have indeed altered the governance structure and priorities of the Swedish research system, focusing public R&D expenditure in some areas judged to be of specific importance. In addition, the institutional block grants to the universities and HEIs have been gradually increased in the bills, and part of this institutional core funding has also become subject to a performance-based allocation scheme. Specific investments have also been made in programs to recruit internationally prominent researchers to Swedish academic institutions, to support young researchers, and for projects and programs in foremost the life sciences, including the new SciLifeLab. A number of policy measures aimed at increasing the commercialization of academic research, including efforts to strengthen the institute sector and further develop innovation support structures at universities and university colleges, have also been made, partly in answer to recommendations by the Council of the European Union made in the spring of 2012.

The poor innovation performance of the Swedish economy, despite the comparably strong showing in R&D investments on both the public and the private side, has been a topic of discussion for at least two decades (the concept of a 'Swedish Paradox' is usually invoked to illustrate this) but only recently led to specific, targeted efforts to increase innovation in SMEs and improve the commercialization of academic research results. The main structural challenges facing the Swedish innovation system are attributable to this 'Swedish Paradox' and are deeply historically rooted and structurally determined, and thus judged both difficult and time-consuming to change:

- Deep structural division and separation between the public and private R&D sectors prevents exchange between them, especially academy-industry knowledge transfer
- Public R&D system characterized by breadth rather than cutting-edge
- Domination of the private R&D sector by very few and very large MNCs; Comparable lack of SME R&D efforts

- Decentralized and incoherent research and innovation policy system; Unclear role of the universities and HEIs in the innovation system
- Comparably poor entrepreneurial climate because of a lack of adequate incentive structures for business start-ups compared to regular employment

The 2012 National Innovation Strategy issued by the Ministry of Enterprise, Energy and Communication shares the analysis of the 2008 and 2012 research and innovation bills that Sweden need to strengthen and improve quality of national R&D in order to keep a competitive position in the globalized knowledge economy. The innovation strategy is, however, mainly a framework vision statement and does hence not launch any concrete policies. Strangely enough, the innovation strategy is silent on several important issues, such as Smart Specialization.

The 2010 deregulation of the academic sector has so far not led to any distinguishable changes in practice and its real effects thus remain to be seen. The policy mix has not been altered to any notable extent in the past year, and so it is basically the same system and actors that have been responsible, in 2012, for implementing and overseeing the policies and priorities of the 2008 research bill and that will, beginning in 2013, work with the priorities in the new research bill.

As to the private sector, BERD as percentage of GDP is shrinking in Sweden and has done so for the past decade. In recent years, some discontinuous changes have occurred to the private sector side of the innovation system, most importantly the closing of research sites in Lund (2010) and Södertälje (2012) by AstraZeneca and Sony Mobile's closing of an R&D site in Lund (2012). Though recent policy measures on central level undoubtedly have entailed specific investments in the life sciences in both Lund and Stockholm/Uppsala, it is difficult to assess the extent to which they were indeed tailored to directly mitigate the effects of these changes in the private sector.

In recent years, another disturbing realization has been added in the shape of decreasing numbers of university graduates in science and engineering fields, a development that has been going on for at least the past decade. In combination with the relative dominance of MNCs in the private R&D sector, this development threatens Sweden's position as a high-skill labour market, since diminishing supplies of well-educated people in Sweden may lead to the relocation of the R&D activities of MNCs abroad.

Swedish policies for research and innovation are generally well at terms with the ERA pillars and objectives, although policy reforms and initiatives are seldom or never linked to ERA pillars and objectives in official documentation. In many ERA dimensions Swedish policies are on the way to meeting the goals, but the shortcomings mentioned in the above paragraphs are still challenging both to the national Swedish research and innovation system and to its harmonization with the rest of Europe. Sweden is still relatively far from the goal of a single European labour market for researchers, in particular to offer attractive permanent positions at HEIs. It is important to note that the role of the Swedish research and innovation system in strengthening the long-term common European competitiveness is downplayed, not to say straightforwardly neglected, in governmental research and innovation policy, in favour of national considerations and the strengthening of Swedish *national* competitiveness.

The main challenges facing the Swedish national innovation system, although both well-known among scholars and acknowledged in governmental policy documents, are only partially addressed in policymaking. Governmental research and innovation policies have launched strategic efforts to prioritize and strengthen particular areas of R&D judged to be critical for the

future of Sweden, but not addressed those fundamental structural features of the economy that appears to inhibit nimble adaptation to the new globalized knowledge economy. The incentives structures for dynamic academy-industry interaction and innovation-based entrepreneurship are still insufficient and economic policy (including labour law) is still geared towards traditional production industry and the domination of a few large companies, thus not particularly suited for meeting the global competitiveness challenges of the 21st century. In short, it seems governmental innovation policy is limited to some institutional and legal rearrangement within existing policy areas and sectors (academic, labour market, tax code) but is curtailed when it comes to profound restructuring of the economy and the innovation system. While this is a seemingly normal state of affairs in the Western world, it does constitute a growing problem.

The Swedish national progress on innovation union commitments is varying and somewhat difficult to assess, as some measures have clearly been taken that mark such progress, but the coherence between these measures and the commitments as such, is opaque. Swedish national policy is seldom explicitly aligned with EU policy directives and the response of Swedish national research and innovation policy to the challenges as defined in EU documents is often coincidental rather than planned. Nonetheless, some progress can be seen, for example in the launch of programs and initiatives on national level to meet challenges related to the supply of venture capital, the mitigation of public procurement of innovation, and the facilitating of intensified knowledge transfer and open access to scientific results.

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1. BASIC CHARACTERISATION OF THE RESEARCH AND INNOVATION SYSTEM

With a population of 9,633,589 (November 1, 2013), Sweden is the home of approximately 1.9% of the total EU-27 population (Statistics Sweden 2013). Sweden's GDP per capita (2011) is almost 1.7 times that of the EU-27 average, namely €42,800 (EU-27 average €25,600), and the GDP growth rate was 0.9% in 2012, compared to 2.9% in 2011 and 6.6% in 2010. Sweden has long since been one of the countries in the world with a highest annual R&D investment in percentage of GDP (only surpassed by Finland and Israel) and is consequently the EU country with the second highest total annual R&D expenditure relative to GDP, after Finland. In 2012, Swedish domestic R&D expenditure amounted to 3.41% of GDP, compared to an estimated average of 2.05% for EU-27. The long-term trend for Sweden is however a decline in R&D intensity, with the figure on total R&D investments as a share of GDP dropping from 4.18% in 2001 to 3.41% in 2012. This development is opposite to most EU countries, where corresponding figures have increased over the same period. The explanation for the decline lies predominantly in the private sector, as Business Expenditures for Research and Development (BERD) relative to GDP has shrunk from 2.74% in 2008 to 2.31% in 2012. Public investment in R&D has fluctuated somewhat in recent years, but remained steady on long term, amounting to approximately 0.8% of GDP in 2012. The turnover from innovation, defined as the share of total turnover of an enterprise and market that comes from products and services that are new to the enterprise and new to the market, has fluctuated between 8.4% and 15% in 2006-2010 (EU-27 average in the same period was around 13.5%; newer data is unfortunately not available) (Eurostat 2013).

Sweden is widely regarded as one of the world's most knowledge-intensive countries, and is mentioned as part of the group of "very high knowledge-intensity countries" (together with Denmark, Finland and Switzerland) in the Innovation Union Competitiveness Report (European Commission 2011). On the performer side, the public R&D system is dominated by the universities and higher education institutions (HEIs). The universities, in total 15, consumes over 90% of the governmental appropriations for R&D and are in principle responsible not only for basic research, but also applied and strategic research programs, including those launched in recent governmental research and innovation bills to strengthen Swedish long-term competitiveness and increase the societal benefit and commercialization of R&D. The several regional university colleges and the very small (albeit growing) R&D institute sector complement the universities but account for a very small share of the public R&D appropriations (Hallonsten and Holmberg 2013). Both the education and research missions of the university and HEI sector expanded dramatically in the second half of the 20th century, with one effect being a thirty-fold (!) increase of the total number of enrolled students between 1940 and 2012, and a similar increase in research volume. While this is by no means a unique development in international (European) perspective, the unusual breadth and scope of the mission of the Swedish university sector compared to other countries is partly the result of this development – as part of the expansion, the university sector swallowed all new missions (including vocational training and a lot of application-oriented public R&D) invented by policymakers. The business sector R&D is mainly internal to large enterprises, as the majority of the funding of R&D in the private sector remains within the comparatively small number of very large companies, i.e. the same organizations (firms or groups) are both funder and performer. A key structural feature of the Swedish research and innovation system is, hence, the compartmentalization of different sectors within which funding flows tends to stay. A manifest feature of the current governmental research and innovation policy doctrine is therefore also to loosen this sharp division and

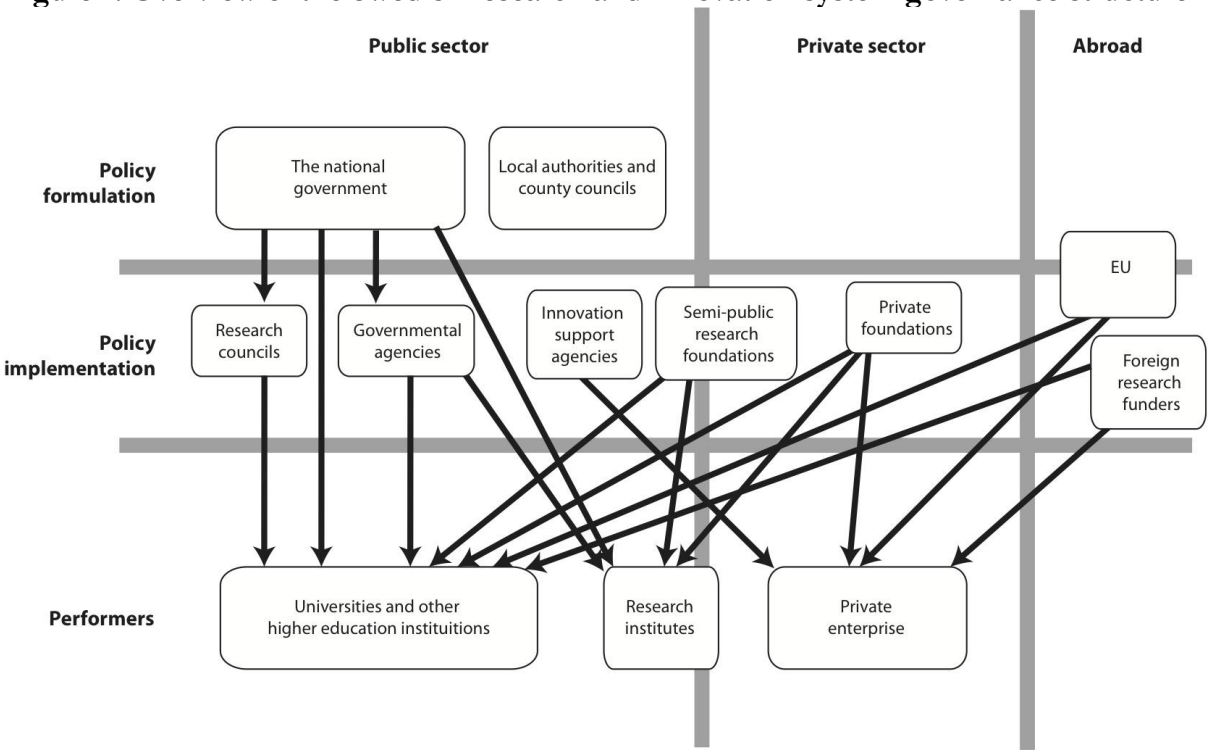
incentivize collaboration across the boundaries between academia and industry, in order to secure long-term competitiveness of the Swedish economy, and adjacently thereto, to partly break the heavy dominance of a few very large actors in both sectors (large universities and large MNCs, respectively). Another prominent feature of the system is the high level of institutional autonomy on the level of the performers in the public R&D system, which stems from a historical combination of strong academic autonomy and relatively weak central political power in the area of research policy. Among the effects of this heritage in today's research and innovation system is a continued prevalence of informal governance at ministry and agency levels, a decentralisation of responsibilities for innovation policy to regional authorities (counties) and universities, a default division of labour between a small number of 'top' universities accounting for most of the public sector research and a larger number of education-intensive higher education institutions, and a relatively weak research institute sector.

The quadrennial research and innovation bill, identifying long- and short-term goals for the public research system and a budget framework for the coming four years, is the key national policy document in the area, and all research agencies, universities, and colleges provide input to the work to formulate the bills. In addition, the Research Policy Council (RPC) established in 1962 has an important advisory role in governmental research policy bills every fourth year; it was also complemented by an Innovation Policy Council (IPC) in 2004. Other bodies in regular but informal advisory roles are the Royal Swedish Academy of Sciences (KVA) and the Royal Engineering Sciences Academy (IVA). The latest research and innovation bill (2012) outlines the government's aim of its national research policy to be that Sweden remains a strong global player in R&D, by enhancement of the quality of research and the contribution of research to society and the economy. Like its predecessor (2008), the 2012 bill is explicitly aimed at enhancing quality and stimulating commercialization of research, and also adds substantial increases of funding in several areas over the years 2013-2016, which will mean that annual governmental investments in R&D will have increased with approximately one billion Euro between 2008 and 2016. The priorities in the 2012 research and innovation bill reflect well the overall priorities in the Swedish national research and innovation system. The only disciplinary area specifically identified as prioritized in the bill is life science. Other than that, the bill is focused on strengthening funding for universities and HEIs, both via the base grants and various competitive schemes, significant investments in research facilities (including the Science for Life Laboratory in Stockholm/Uppsala and the European Spallation Source and MAX IV facilities in Lund), and on enhancing academy-industry collaboration and the commercialization of research results. Apart from the research bill, the government also drives the research policy development through annual budgets, regulations, and the appointment of board members in agencies and foundations. The late 2012 Swedish National Innovation Strategy issued by the Ministry for Enterprise lays out some broad objectives for the Swedish innovation system, such as a continued strengthening of the national innovative capacity to keep up with international competition, an improvement of the innovation climate for SMEs, an increased direct innovation support, and the strengthening of the rather weak Swedish research institute sector, but little or no concrete policies – these are reserved to the research bill and other future legislative action by the Ministries of Education and Enterprise, respectively.

Apart from the government, two other authorities play an important role in policymaking, the National Agency for Innovation Systems (Vinnova), working to promote growth through innovation, and the Swedish Research Council whose mission as funder of basic research (in the academic sector) through competitive programs is combined with a strategic role as advisor to the Government on issues relating to research policy. Besides the Swedish Research Council a number of specialized research councils as well as public and private research foundations also

fund R&D, and besides Vinnova a number of intermediary agencies work with the promotion of innovation, providing venture capital and advice at different stages in the innovation process as well as incubator functions, such as the Swedish Agency for Economic and Regional Growth and the Swedish Energy Agency. The regional promotion of research and innovation takes place on the level of the 21 counties, whose relative power and influence has increased over the past few decades. The current reorganization of the administrative division of Swedish regional government, aiming at gradually replacing the counties with larger *regional* authorities with a broader and more comprehensive portfolio, is also strengthening the responsibility for innovation policy on regional level. The 2012 governmental research and innovation bill stresses the necessity to link regional growth initiatives with national research and innovation policy. In May 2013 the government assigned to regional and national authorities the task of developing regional development programmes for 2014-2020, including research and innovation strategies.

Figure 1: Overview of the Swedish research and innovation system governance structure



2. RECENT DEVELOPMENTS OF THE RESEARCH AND INNOVATION POLICY AND SYSTEM

2.1 National economic and political context

The global financial crisis of 2007-2009 and the subsequent crisis of the Euro zone left its mark on Sweden just as other countries across Europe, although in the opinion of most analysts domestically as well as internationally, the Swedish economy was spared from the most disturbing effects of the crisis. That Sweden is not a member of the Economic and Monetary Union (EMU) has also put the country and its domestic economy in a relatively less exposed situation, and has also meant a direct advantage in most recent years. Expectedly, given the state of the international economy, Swedish growth in GDP was negative in 2008 and 2009 (-0.6% and -5.0% respectively) but turned up again in 2010 and reached the highest among the EU-27 countries that year, +6.6%. In 2011, the growth rate returned to a slightly lower but still historically high level of +2.9%, compared to the EU-27 average of +1.5%, and in 2012, it fell to +1.0% compared to the negative EU-27 average (-0.4%). In all, the Swedish economy appears to have managed the financial crisis and the Euro crisis well, although some slowdown in growth is discernible, and these can therefore not be said to have had significant impact on the Swedish R&D system, although there are signs of coming impacts in the shape of possible cuts in the labour forces of large exporting companies, due to currency appreciation and the recession in some parts of the Swedish export markets.

There are three main domestic developments of importance. First, the current process to deregulate the university sector, within which the major reform was implemented in 2010, giving universities and higher education institutions full discretion of determining their internal organizational structures, and an extension is currently under discussion that would give universities and higher education institutions the opportunity to privatize within the framework of private foundations (Swedish Government 2008b; Swedish Government 2013a). Second, the effects of the 2008 and 2012 research and innovation bills and their major increases in funding for university research, including the large Strategic Research Areas (SRA) grants of 2008 and their follow-ups in 2012 (see sections 3.3, 5.2 and annex 3) (Swedish Government 2012b; Hellström 2012). Third, the formulation and implementation of the National Innovation Strategy, which has begun at a smaller scale. The increases in public research funding have, to some extent, mitigated the effects of the gradually diminishing private Swedish investments in R&D that are visible in statistics: estimated BERD as % of GDP has shrunk from 2.73% in 2008 to 2.31% in 2012. Among the distinct events that play a part in this development is the closing of two of the research sites of the multinational company (MNC) AstraZeneca, in Lund (2010) and Södertälje (2012) that brought a layoff of thousands of professionals in drug development and associated life sciences areas. Partly in response to these events, the government decided to invest heavily in a new life science laboratory (the Science for Life Laboratory, SciLifeLab) in Stockholm/Uppsala (Swedish Government 2012a). In addition, two large publicly funded research facilities for materials science are planned and under construction in Lund in Southern Sweden; the Nordic MAX IV facility for synchrotron radiation (under construction) and the intergovernmental collaborative European Spallation Source, ESS (under planning). Together with SciLifeLab, these constitute investments in R&D on a scale unprecedented in Sweden (Benner 2012b). However, while SciLifeLab and MAX IV are under construction, there are some signs that the international negotiations over the ESS have come to an impasse, and so although the Swedish government

has invested heavily in the future facility already, it is far from certain whether it will actually become reality (Hallonsten 2013a). On the level of direct financial support to industry, some funding was also directed towards saving the Swedish car manufacturing industry in the wake of the global economic crisis and the ensuing crisis for Ford and General Motors whose financial trouble in 2009, as owners of SAAB Cars and Volvo Cars, worried the Swedish government.

2.2 Funding trends

As mentioned, and as seen below in Table 1, Basic indicators for R&D investments, the Swedish R&D investments as a share of GDP are decreasing on overall level (all sectors), as well as in business enterprises and the public sector. It should be noted, in this context, that the major turn in GDP growth rates between 2009 and 2010 from -5.0% to +6.6%, as a result of first the financial crisis and then Sweden's quick recovery, has an impact on these figures. The decrease in R&D investments as percentage of GDP is on par with the growth rates and thus, on the level of these statistics, there have been visible effects of the global financial crisis on the Swedish R&D funding system. However, in real terms, little change is discernible – the level of annual R&D investments has remained stable in the most recent years.

2.2.1 Funding flows

The Swedish government has no explicitly set national R&D investment targets, but appears largely satisfied with the current situation where Gross Domestic Expenditure on R&D (GERD) exceeds the EU goal of 3% of GDP. The effects of the economic crisis in Europe has, quite naturally, had an indirect impact on the performance of Sweden relative to other European countries (cf. the note in an earlier section on the crisis' comparably small damage on the Swedish economy). The decline in Business Expenditures for Research and Development (BERD) has not been discussed to any length in recent important governmental policy documents (e.g. the 2012 research and innovation bill and the 2012 national innovation strategy); these instead highlight the increase in Government Budget Appropriations or Outlays on R&D (GBAORD) in the past three years and in coming budgets, which indeed lack precedent and amount to a total increase in the annual GBAORD with almost one billion Euro in 2016 compared to the level in 2009 (Swedish Government 2012b: 15).

While this increase to some extent increases the spending on R&D across the whole academic sector, it has also especially benefited the large and old universities, both by the explicit decision of the policymakers to increase funding in the established universities and because the focus of some of the programs on academic excellence have tended to make the programs favour research environments of a certain volume, which are more likely to exist in the larger universities (Benner et al 2010; Hallonsten and Silander 2012; Sandström et al 2010. The decline in BERD has mostly been caused by downsizing by a few very prominent players in the R&D-intensive private sector. Since private sector R&D in Sweden is dominated by a few very large MNCs, it is especially vulnerable to their reorganization and reprioritization in the wake of globalization.

The governmental appropriations for R&D in the academic sector is still the largest share of the total GBAORD, amounting to approximately €1.6b or 48% of the total annual GBAORD. The share channelled through the research councils and similar agencies for R&D amount to approximately €900mor 26.5%, and the remaining 25% are shared by the governmental budgets for defence, energy, foreign aid and a number of smaller civilian agencies. Little more than approximately €140m were paid out for R&D activities by the public research foundations in 2012, and approximately €220m of EU funding for R&D was channelled to the public Swedish

R&D system in the same year, and local and regional government spends approximately €200m on R&D annually. These relative shares of the GBAORD and the income in the public R&D system have been almost unchanged in the past few years and are also expected to remain so, with the possible exception of a relative increase in direct governmental appropriations for R&D in the academic sector and the governmental funding channelled through research councils, both of which are affected by the further increases of governmental R&D investments envisaged in the 2012 research bill.

The Swedish National Agency for Innovation Systems (Vinnova), a major player in the public R&D system and a promoter of innovation in the private and public sectors alike, has received substantial increases to its annual budget in the past decade, with governmental appropriations to the agency rising from approximately €150m in 2007 to approximately €260m in 2014.

Table 1. Basic indicators for R&D investments

	2009	**2010**	**2011**	**2012**	**EU28**
GDP growth rate	-5.0	6.6	2.9	0.9	–0.4*
GERD (% of GDP)	3.62	3.39	3.39	3.41	2.06*
GERD (euro per capita)	1,136.6	1,270.8	1,386.6	1464.9	525.8*
GBAORD - Total R&D appropriations (€ million)	2,438.9	2,859.8	2,958.5	3,293.3	86,309.5*
R&D funded by Business Enterprise Sector (% of GDP)	2.14	n/a	1.94	n/a	1.12***
R&D performed by HEIs (% of GERD)	25	26	26	27	24*
R&D performed by Government Sector (% of GERD)	4	5	4	5	12*
R&D performed by Business Enterprise Sector (% of GERD)	71	69	69	68	63*
Share of competitive vs. institutional public funding for R&D	58.4% / 41.6%	54.7% / 45.3%	55.2% / 44.8 %	54.4% / 45.6%	n/a
Venture Capital as % of GDP	0.075	0.070	0.061	0.053	0.025****
Employment in high- and medium-high-technology manufacturing sectors as share of total employment	5.5	5.0	4.7	n/a	5.6*
Employment in knowledge-intensive service sectors as share of total employment	50.3	50.6	51.2	n/a	38.9*
Turnover from Innovation as % of total turnover	n/a	8.4	n/a	n/a	13.4*****

1 (Sources: Eurostat 2013; Statistics Sweden 2013)
2 **EU-28 (2012)***
3 **EU-27 (2012)****
4 **EU-27 (2011)*****
5 **EU-15 (2012)******
6 **EU-27 (2010)*******

2.2.2 Funding mechanisms

2.2.2.1 Competitive vs. institutional public funding

The long term development of the governmental funding stream to the public R&D system, dominated by the universities, is typical in international perspective: Before the huge expansion periods in the mid- to late-20th century, academic R&D was almost completely funded by the institutional block grants issued by the government and largely dimensioned according to historical patterns, with some year-by-year adjustments. The development since the 1940s, when the first few research councils were founded, and on through the remaining decades of the 20th century when several new funding bodies emerged and gain in importance, has hence been dominated by a general and gradual phasing over of the funding responsibility for academic R&D from direct institutional appropriations by the government to competitive so called third party funding, from a mix of public and private sources (Engwall and Nybom 2007).

The two latest major reforms to the funding system were (1) the creation, in the early- to mid-90s, of a number of public research foundations, and (2) the 2001 restructuring of the research councils. While the former meant an injection of a large amount of money into the system, the effect of the latter in pure monetary terms is more disputable. The public research foundations created in the 1990s were the result of the decision by the then centre-right government to abolish the so called "wage earners funds", a remnant of 1970s social democratic policies to gradually socialize Swedish industry and transfer ownership to funds controlled by the trade unions. The research foundations created by the dismantling of these funds in 1992-94 were all specialized in certain areas of funding such as internationalization of research, academy-industry interaction, and support for research in the newer (post-1977) higher education institutions (HEIs) (Benner 2005).The share for these new foundations of the total amount of competitive funding for R&D in the academic sector has oscillated between 8% and 14% in the past ten years (or between approximately €100m and €150m in real terms) (Swedish Higher Education Authority 2013). The 2001 restructuring of the research councils merged four previous research councils (the Humanities and Social Sciences Research Council, the Medical Sciences Research Council, the Natural Sciences Research Council and the Technical Sciences Research Council) as well as the National Council for Planning and Coordination of Research into the larger, broad-encompassing Swedish Research Council, and simultaneously created the Swedish Agency for Innovation Systems (Vinnova), as well as two specialized research councils (the Swedish Council for Working Life and Social Research, FAS, and the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning, Formas) (Engwall and Nybom 2007: 42). It did not alter the funding streams from the research councils significantly, but did add another funder, Vinnova, with its own funding portfolio geared towards commercialization of academic research and funded by the Ministry of Enterprise, Energy and Communication rather than the Ministry for Education and Research, which expanded the funding source for the universities.

The overall trend, also when looking at the past three to four decades, is thus unambiguous: The share of competitive funding for public R&D in Sweden has increased significantly and overtaken, not in real terms but relatively, a large share of university research that was previously funded by institutional block grants issued directly to the universities. The variations in the ratio between competitive and institutional funds, seen in table 1, is due to the various funding increases launched in the recent two research and innovation bills (2008 and 2012) and discussed elsewhere in this report. Especially the rather substantial increase in the share of institutional grants between the years 2009 and 2010 is due to the effectuation of the major increase of the institutional block grants issued in the 2008 research bill.

2.2.2.2 Government direct vs. indirect R&D funding

On the side of the private sector, the regulations regarding tax deductions and tax incentives for R&D have not changed significantly since the launch of the current tax code in 1970. R&D expenditure is deductible if the R&D activities can be proven to have direct relevance for the main business activities of the firm in question. A current governmental investigation, charged with making a general and exhaustive assessment of tax deductions and tax incentives for R&D in the private sector, delivered its report to the government in September 2012 and suggested some minor changes to the tax code, most importantly a lowering of the general payroll tax for employees in R&D, and some adjustments to current EU regulation, but the result of the investigation has yet to become translated into policy (Swedish Government 2012e).

The Swedish Agency for Innovation Systems (Vinnova) has a variety of funding programs for innovation and R&D in the private sector, especially SMEs, among which the Forska&Väx programme is the most prominent, awarding an approximate €6m annually to innovative projects in SMEs.

2.2.3 Thematic versus generic funding

The overwhelming majority of the governmental appropriations for R&D is generic funding in the sense that broad research areas are defined and the funding provided with no other specific earmarks. This is of course true for the institutional block grants, making up little less than 50% of the R&D funding in the universities, and the lion share of funding allocated through the Swedish Research Council (which channels approximately ¼ of the total competitive funding).

The largest areas of support subject to thematic and sectorial funding in Sweden are energy, environment, space technology, foreign aid, and medicine. These are identified by the government as important areas for Sweden to prioritize, and while they partly overlap with the grad challenges as identified on European level, there is no mentioning of the latter in the R&D policy documents and budgetary documents of the Swedish government. In addition, substantial parts of the funding from other governmental agencies and especially the semi-governmental public research foundations (see above) is funding earmarked for innovation activities in the universities (channelled mostly through Vinnova, but also to some extent, by other actors), internationalization of Swedish research, and academy-industry relationships. Of the GBAORD in 2013, 62% was channeled directly to the universities, within which a minuscule amount (only 3.8%) was funding within the Strategic Research Areas grants that is one of the major thematic priorities of the governmental policy (see sections 3.3, 5.2 and annex 3). Other funding within thematic priorities is difficult to get an exact view on, since such funding is allocated through many different channels including the governmental appropriations to the universities, the budget of the Swedish Research Council and Vinnova, and the other research councils. However, as noted in the previous paragraph, the bulk of the GBAORD remains non-earmarked.

2.2.4 Innovation funding

The two most recent governmental research bills have been named "research and innovation bills", a name change that breaks with a 25-year old tradition of quadrennial governmental *research* bills and that signals a move from pure R&D policy and funding to broader R&I policy and funding. In addition, the 2001 founding of the National Agency for Innovation Systems (Vinnova) with its specific task of supporting innovation in the public and private sectors, and

this agency's recent budget boost (see section 2.2.1) signals a gradual shift in priorities in this direction, on the government's behalf. The current work with Horizon 2020 and the recent governmental National Innovation Strategy (see section 2.4) are also testament to a vivid interest in innovation policy and support.

However, as noted in section 2.2.3, the absolute lion's share of governmental R&D appropriations is either generic funding to the universities or generic funding for competitive schemes (run by e.g. the Swedish Research Council), and although universities are nowadays (since 2009) required by law to seek the utilization of research results, most university research is still rather on the R side in R&D, and most definitely on the R side of R&I. As for the balance between research funding and innovation funding, this is therefore still heavily tilted towards research funding. Developments in the direction of a more comprehensive inclusion of innovation into the government's R&D policy and support have, however, been significant, as noted in the previous paragraph. Value or norm system changes such as the legislation change that in a sense added innovation to the mission of universities, or the name change to the governmental research bills, do typically have far reaching impact on long-term, also beyond what is measurable in pure funding numbers.

2.3 Research and Innovation system changes

The policy measures launched and implemented by the government in the past few years to strengthen Swedish R&D, innovation and long-term competitiveness are not considered to be direct effects of the financial crisis or the general state of the economy but rather part of an on-going governmental ambition to increase quality of research and intensify the commercialization of R&D in Sweden, partly based on policymakers' interpretation of the popularized 'Swedish Paradox' concept; that despite the high level of R&D investments as share of GDP (see above), Sweden performs less well in knowledge-based innovation-driven economic growth.[1] The specific funding programs launched in the two most recent research bills are quite new and not likely to be possible to assess the effects of. Something similar can also be said about the policy reactions to the closing of the AstraZeneca site in Södertälje south of Stockholm in the shape of a new major investment in the SciLifeLab; this investment will commence in 2013. The other two big facility projects ESS and MAX IV are likely to make their first deep imprints in the distribution of funds and in the performance of the R&D system as a whole in a decade's time, at the earliest.

2.4 Recent Policy developments

The past year has seen the beginning of the implementation of the policies launched in the 2012 research and innovation bill, the content of which has been briefly mentioned several times above but will be outlined in greater detail here. The bill lays out the government's research and innovation policy for the present year and the coming three years and is the central policy document for all actors (see above) in the system. The National Innovation Strategy, published by the Ministry of Enterprise, Energy and Communication in November 2012, will be reviewed below.

The main parts of the 2012 research bill are as follows (Swedish Government (2012b):

[1] For the scholarly debate on the 'Swedish Paradox' see, for example Edquist and McKelvey (1998); Ejermo and Kander (2006).

- The government considers increases in the appropriations for research and the stimulation of innovation to be important measures for increasing the general level of quality of Swedish research and accordingly launches several general and specific funding increases.
- The total R&D appropriations are given an increase of €200m for 2013, and the government signals its intention to make further increases of €110m in 2014 and €42m in 2015.
- The appropriations for research and doctoral training in the academic sector gets an increase of €25m 2013, and the government signals its intention to commence further gradual increases so that the level of appropriations for research and doctoral training in the academic sector is in total €140m higher in 2016 than in 2012.
- The Swedish Research Council is given the task of launching targeted programs to make international recruitments of prominent researchers to Swedish academic institutions and to support young researchers, for which the council is given an additional funding of €20m for 2013.
- A specific investment of €52m is made in the life sciences, including targeted efforts in infections and antibiotics, aging and health, treatment research, and drug development. Part of this investment goes to SciLifeLab and a new institute for process development and catalysis.
- Specific investments of €48m for 2013 are made in areas judged to be of particular importance for Swedish industry and the welfare society, including forestry and biomass, mining, minerals and steel, the sustainable society, space research, energy research and evidence-based education and preschool.
- A number of policy measures aimed at increasing the commercialization of academic research are also presented, including efforts to strengthen the institute sector and further develop innovation support structures at universities and university colleges.

Most of these policies are currently being implemented, and it is too early at this point to make any qualified evaluation of their effects on the system.

The National Innovation Strategy is a general framework policy document formulated and issued by the Ministry of Enterprise, Energy and Communication. Contrary to the quadrennial research bill, it is not a governmental bill and consequently, it does not launch specific policies. Its weight as a policy document can therefore be questioned, especially since the actual policies delegated to Vinnova have been stipulated in the already discussed research bill. However, the main elements of the National Innovation Strategy are as follows (Swedish Government 2012c):

- Acknowledging that Sweden faces growing international competition as a knowledge-based economy, and that Sweden, Europe and the world will have to rely on its innovative capacity to meet the challenges of the future, there is a need for a purposeful and coordinated national innovation strategy in Sweden.
- Sweden has a favourable position but will have to mobilize to keep up with international developments.
- The framework conditions for innovation need to be improved, including high quality education, a vitalized innovation climate among especially SMEs, increased mobility between different sectors of the economy and society, and quality enhancements of research in academia
- Direct innovation support has to be intensified, foremost in the shape of bridging institutions between different societal sectors and especially academia and industry, and other innovation support infrastructures.
- The research institute sector is in need of vitalizing and strengthening.

In the fall of 2013, a national meeting was held to mark a "stopover in the implementation of the National Innovation Strategy", where the Minister for Enterprise presented the work, so far, of implementing the strategy. Among the items discussed were the work of Vinnova to define criteria for the eventual evaluation of the innovation strategy, and the recent launch of a governmental policy to strengthen business incubators in Sweden which includes an addition of €3m in the annual appropriations of the incubator program run by Vinnova (Swedish Government 2013b; 2013c).

2.5 National Reform Programme 2013 and R&I

The four 2013 European Commission's recommendations for Sweden – Sustainable public finances; Private indebtedness (households and corporate sector); Constraints in the housing market; and Improved labour market integration – have little or no relevance for the R&D sector.

2.6 Recent evaluations, consultations, foresight exercises

A recent governmental investigation evaluated the innovation support activities at Swedish universities and found that the capacity was "surprisingly well functioning, despite the imperfect conditions." The evaluation concluded that the deficits in the Swedish innovation system are extensive but possible to alleviate with a deliberate governmental strategy that strengthens the role of the universities as leaders in regional innovation systems by adapting regulations and increasing the earmarked funding for their innovation support activities. Especially the lack of room for providing seed money and management support for start-ups, are striking, according to the investigation (Swedish Government 2012d).

The Ministry for Enterprise, Energy and Environment gave the task to the OECD to undertake an evaluation of the Swedish innovation system and suggest policy measures for its improvement. The report, presented in November 2012, names Sweden as one of the world's leading countries in the area of innovation but criticizes the Swedish system for insufficient academy-industry interaction, lack of strong enough excellence centres at Swedish universities and lack of national coherence in innovation policy. The report also echoes previously mentioned themes; Sweden is too heavily reliant on MNCs and their R&D investments in Sweden, which presents great risk if any one or a few of these very large companies decide to move their R&D investments elsewhere. The report recommends an oversight of the system of venture capital and a consolidation of national policymaking to create better policy coherence (Sundström 2012). An evaluation by the Royal Swedish Academy of Engineering Sciences makes a similar analysis, criticizing the Swedish innovation system for lack of coherence and too many actors working independently of one another. The report proposes a comprehensive strategy to create a more favourable culture for innovation in Sweden, largely driven by a strong policy showing that signals a determination on behalf of Swedish policymakers to enhance the innovation climate. A number of concrete proposals are also made, including changes in the incentives structures for innovation and entrepreneurship, such as tax deductions for venture capital, simplification of regulations, and better legal frameworks for intellectual property (IVA 2011).

2.7 Regional/National Research and Innovation Strategies on Smart Specialisation (RIS3)

The implementation of the Regional/National Research and Innovation Strategies on Smart Specialisation (RIS3) in Sweden is only on early planning stage, and it is at this point not entirely clear on what level of government the responsibility for formulating and executing these strategies will be laid. With the 2012 National Innovation Strategy in place, and with the current implementation of the first policy changes of the 2012 Research and Innovation Bill, the policy roadmap on national governmental level is laid out. On regional level, however, the situation is slightly more complex. Sweden is currently undergoing a gradual transformation of its regional government subdivisions; and so far, new so called Regional Boards have overtaken responsibilities for regional development from Country Administrative Boards in four regions; in Skåne, the southernmost region around Malmö; in Västra Götaland, the region around Gothenburg in south western Sweden; in Halland, the region geographically located between the two former; and in Gotland, the island county in the Baltic Sea. In addition, in late 2013, the government has instructed the Jönköping, Örebro and Gävleborg counties to restructure into Regions with Regional Boards. These Regional Boards, and an association of municipalities and the county administrative board in the north of Sweden called the Västerbotten Region, have made independent efforts to formulate regional innovation strategies (see e.g. Region Skåne 2011), and it is expectable that RIS3 strategies will be incorporated in these strategies in the near future. On national level, the responsibility for RIS3 strategies lies with the Ministry of Enterprise, Energy and Communication, and its agency the Swedish Agency for Economic and Regional Growth (Tillväxtverket). Discussions are still underway regarding the approach to be taken by Sweden in the implementation of RIS3 strategies.

The Swedish Agency for Economic and Regional Growth has initiated some work with the RIS3, including a launch conference together with Vinnova and the Skåne Regional Council in November 2013 under the headline "Get smarter together in the Baltic Sea Region", where regions are invited to establish contacts and discuss their future RIS3 strategies, in generally oriented sessions as well as in specialized sessions on so called "e-Health" and "Smart Cities" (Swedish Agency for Economic and Regional Growth 2013).

RegLab is an interest group for learing and competence development where Swedish regions, Vinnova and the National Agency for Growth are members, and they have started a collaborative project where the regions work together to develop their Smart Specialization strategies, mainly through the method of "twinning" by which is meant that two or more actors share knowledge and experience. The project is only in its infancy but engages all Swedish regional authorities and can therefore be seen as the first national initiative around Smart Specialisation (RegLab 2014).

3. PERFORMANCE OF THE NATIONAL RESEARCH AND INNOVATION SYSTEM

3.1 National Research and Innovation policy

In EU perspective, Sweden performs generally well in R&D, with high levels of GERD as % of GDP (see section 2.2.1, esp. table 1) and not least a performance well above average on several specific accounts (education levels, publications and patents), as seen in table 2 below.

As noted, the Swedish R&D system is dominated by the two comparably insulated sectors of business enterprises, responsible for two-thirds of the total annual investment in R&D in Sweden and largely spending this money internally, on in-house R&D, and the public side which is still dominated by the academic sector and funded by the government. The reach of national policymaking therefore extends mainly to the academic sector, and though efforts are and have been made (see previous chapter) to strengthen the role of actors working in the borderland between academia and industry, the main structural challenge is still the relatively stark separation between the two dominating sectors.

This separation is also the foundational reason for the structural deficit of Sweden (discussed in greater detail in the next section) that is usually referred to as the 'Swedish Paradox' – it is generally believed that despite strong showings in many indicators, results and returns do not match investments, compared to other countries. In the Innovation Union Competitiveness Report, R&D intensity in Sweden is higher than the reference group (measuring GERD as % of GDP; BERD as % of GDP; and GBAORD as % of GDP), and the figures on doctoral graduates per thousand population aged 25-34 and researchers per thousand labour force also come out in Sweden's favour compared to the reference group. However, as the 2011 country report highlights, Sweden scores lower than the reference groups when it comes to e.g. highly cited publications and patent statistics.

In policy rhetoric, the promotion of research and innovation is considered a key policy instrument to enhance long- and short-term competitiveness and economic growth, address major societal challenges and improve general quality of life. Repeated reviews and scholarly publications have, however, criticized the lack of coherence and coordination of the research and innovation policy system. These critics claim that policy is determined rather out of path-dependence in the political system than inventiveness and the mobilization of relevant policy tools for the challenges of structural transformation (Sandström et al 2008; Hallonsten and Hugander 2014; Benner 2012a; Hellström and Jacob 2005). Although policy is typically formulated and developed in dialogue with key stakeholders, and occupies a central position among governmental priorities, its implementation largely hinges on the deliberations and efforts of actors at lower levels of the system; such as universities and governmental agencies (research councils) and not least of course the private sector actors whose R&D activities make up a large part of the collected Swedish national innovation capacity. In addition, recent policy efforts to guard what is seen as positive elements of a pluralized and decentralized system (e.g. academic self-governance, participation, and consensus) have likely not improved the capabilities of a coherent and effective national research and innovation policy formulation and implementation. The strategic priorities launched in the three recent research and innovation bills have doubtlessly been aimed at solving grand challenges and mobilizing strategically in the Swedish R&D system

but their relative share of the R&D funding system is still marginal, given that the lion share of all public appropriations for R&D is still channelled to the universities largely on basis of tradition (Hallonsten and Silander 2012; Engwall and Nybom 2007).

As discussed at length in the 2013 ERA communication fiche for Sweden and the 2012 ERAWATCH country report, Swedish governmental research and innovation policy is almost exclusively built on the analysis that the competitiveness of the Swedish national economy (and, by extension, society) hinges upon a strengthening of the Swedish *national* research and innovation system, and an associated determination on behalf of policymakers to take action to secure this competitiveness with a heavy focus on the *national needs* of Sweden. Several aspects of national research and innovation policy do partly take into account the policies of other European countries and the research and innovation policies of the European Commission and relevant EU bodies. But little or no Swedish research and innovation policy is explicitly aimed at responding to charges and commitments of the European Union. As a result, the role of the Swedish research and innovation system in strengthening the long-term common European competitiveness is downplayed and often completely neglected in governmental research and innovation policy, in favour of national considerations.

Table 2: Indicators on Swedish National Innovation System

HUMAN RESOURCES	
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	2.93 (2010)
Percentage population aged 25-64 having completed tertiary education	47.5 (2011)
Open, excellent and attractive research systems	
International scientific co-publications per million population	1604 (2011)
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	12.3 (2008)
Finance and support	
R&D expenditure in the public sector as % of GDP	0.81 (2012)
FIRM ACTIVITIES	
R&D expenditure in the business sector as % of GDP	2.31 (2012)
Venture capital and seed capital as % of GDP	0.053 (2012)
Linkages & entrepreneurship	
Public-private co-publications per million population	147 (2011)
Intellectual assets	
PCT patents applications per billion GDP (in PPS€)	10.7 (2009)
PCT patents applications in societal challenges per billion GDP (in PPS€) (climate change mitigation; health)	n/a
OUTPUTS	
Economic effects	
Medium and high-tech product exports as % total product exports	2.02 (2011)
Knowledge-intensive services exports as % total service exports	38.7 (2010)
License and patent revenues from abroad as % of GDP	1.16 (2011)

In sum, Swedish national research and innovation policy is in rhetorical terms very much geared towards excellence and the creation of favourable conditions for private sector innovation but

has also been criticized for a lack of correspondence between this rhetorical level of policy and the actual implementation.

3.2 Structural challenges of the national R&I system

The paramount document formulating and compiling Swedish national research and innovation policy is the aforementioned quadrennial governmental research bill, which has two main functions. First, to lay out the framework for investments and priorities for the coming four years – since all appropriations are decided in the annual governmental budgets, expenditure and thus investments and regular resource distribution in the field of research and innovation, as in any other field, can only be outlined in this and other bills. Second, to formulate and codify the analysis of the state of the Swedish research and innovation system and its virtues and challenges, which is an amalgamated collection of opinions and analyses from all governmental authorities (including the universities and other HEIs) and a large number of relevant stakeholders and interest groups in other sectors (e.g. trade unions, academies, research foundations). Although clearly all these actors involved in the consensus-oriented preparatory work to formulate governmental research and innovation policy do not subscribe to the conclusions of the analysis and the suggested priorities, since these are crucially the product also of political agendas, the basic analysis can indeed be seen as a collected and mediated opinion of the relevant actors in the Swedish research and innovation policy field.

The general assessment of the national Swedish research and innovation system in the 2012 bill largely follows previous analyses (as communicated in the 2008 and the 2004 research bills and also summarized in the ERAWATCH country reports of 2009, 2010, 2011 and 2012) in highlighting the following structural challenges for the Swedish research and innovation system:

- The general level of quality of Swedish (academic) research is already high but needs significant improvements to become globally competitive in coming decades.
- Interaction between the academic sector (basic research) and industry (applied research and development) is generally too low and inefficient, which shows not least in the suboptimal performance in commercialization of research results from academia.
- Swedish public research is impressive in its breadth but needs to improve its specialization and performance in certain cutting-edge fields, and prioritize more clearly between focus areas and less important areas.

However, it is important to note that these structural challenges facing Sweden is typically viewed differently in Swedish domestic perspective compared to the broader EU perspective – as noted above, comparison across European countries puts Sweden in the group of "very high knowledge-intensity countries", joining Denmark, Finland and Switzerland (European Commission 2011).

The shortcomings of the Swedish research and innovation system can, somewhat simplified, be described in terms of a "Swedish paradox". First identified and conceptualized some academic studies of innovation and entrepreneurship in Sweden in the 1990s, this concept has earned great influence in policy circles and been established as common knowledge: Relative to the strong showing in annual R&D investment as percentage of GDP, the returns in the shape of research-based innovations, knowledge-based entrepreneurship, and economic growth in knowledge-intensive sectors, are too low. The "paradox" has been attributed to several structural deficits in the Swedish society, public and private sectors alike. As summarized in the 2011 and 2012 ERAWATCH country reports (Melin et al 2012; Hallonsten 2013c), these are:

- A structural division of labour between on one hand basic research, publicly sponsored and performed almost exclusively in universities and HEIs, and on the other hand applied research and development sponsored and performed internally in the business sector and predominantly internally to single companies.
- Breadth rather than specialization in public R&D system; historical lack of appropriate strategic prioritization
- A relative dominance of large MNCs in the industrial sector
- A centralized and incoherent research and innovation policy system
- A relative lack of venture capital and other critical resources for innovation in SMEs, and a poor entrepreneurial climate due to poor incentive structures for starting firms compared to regular employment that largely stems from the structure of the welfare system which favours wage earners.

Most analysts agree that these structural deficits are historically determined and therefore take deep and time-consuming reform to mitigate. Judging from policy language, the government is determined to make severe efforts in all three areas, but it is difficult to assess the extent to which political reform within the limits of a four year election cycle can accomplish in this area (see next section).

As discussed, the structural challenges facing the national research and innovation system are also due to profound features of the Swedish economy and society in general, and the configuration of the public R&D system specifically. In addition, as noted in the introductory section (1) of this report, the research policy system suffers from some level of decentralization and lack of coordination, which depends on a historically strong academic sector and a lack of central initiative in research policymaking. Key to any analysis of the structural challenges facing the national Swedish research and innovation system is to acknowledge that these two general features of the system – the structural-historical character of the economy

3.3 Meeting structural challenges

Governmental policy formulation has been explicit in at least three consecutive research bills (2004, 2008, 2012), as well as other official documents (e.g. the 2012 National Innovation Strategy) that the public R&D system is in need of strategic mobilization and purposeful efforts to enhance the level of interaction between academia and industry/society to strengthen the innovativeness of the economy at large (Swedish Government 2004; 2008a; 2012b; 2012c; Hallonsten and Silander 2012). As mentioned in section 2 of this report, several specific policies have also been launched to enable and enforce strategic mobilization (the Strategic Research Areas and the recent programs to recruit internationally leading scientists), to raise overall quality levels (resource increases) and to facilitate commercialization of research results (investments in the institute sector and in innovation offices)., and the decentralized and incoherent research policy system – both pose structural challenges in their own right, and inhibit the government's room for manoeuvre in attempting to meet the challenges through national policy. In short, the system retains a large degree of decentralization and a compartmentalized governmental authority structure where governmental agencies are either charged with very specialized tasks (Vinnova), completely focused on the education side of the system (Swedish National Higher Education Authority), or diversified and decentralized by design, by a stipulated collegial and program-oriented governance structure (the research councils) (Sandström et al 2008).

In light of this, it seems slightly paradoxical that the government, on one hand, repeatedly complains about this lack of mechanisms for strategic mobilization and coordinated system-wide efforts, while on the other continues to delegate responsibilities for quality enhancement, the design of new governance mechanisms, and specifically prioritized investments to its agencies and to the universities and HEIs. The most recent governmental reforms to the framework for steering of the public R&D system have strengthened the formal autonomy of universities and stripped the government of its previous privileges of prioritizing between research areas in the R&D appropriations. The responsibility for design and implementation of new quality assessment schemes is laid on the Swedish Research Council. With the exception of the Strategic Research Areas funding scheme and some similar earmarks for specifically designated research areas in the latest research bill (see next chapter), the government relies on the academic institutions and the research councils to distribute funding, and hence also make priorities.

Table 3: Structural challenges and policy responses

Challenges	**Policy measures/actions addressing the challenge**	**Assessment in terms of appropriateness, efficiency and effectiveness**
1. Structural division between public and private sectors in R&D	A series of policy reforms and initiatives in the 2008 and 2012 research bills, most importantly strengthening of institute sector and creation of innovation offices	Policies are adequate in their appropriateness albeit selective. Efficiency and effectiveness difficult to assess.
2. Breadth rather than specialization in public R&D system	Policy initiatives in 2008 and 2012 research bills, most importantly the strategic research areas grants, plus mobilization around some key research infrastructures (SciLifeLab, ESS, MAX IV)	Policy of strategic mobilization appropriate and efficient, but not sufficient; general overhaul of path-dependent priorities inside universities necessary on long term
3. Private R&D dominated by a few MNCs	Stated policy intentions of strengthening entrepreneurship and creation and growth of SMEs; few concrete reforms or initiatives	Lack of concreteness of policies make appropriateness, efficiency and effectiveness doubtful
4. Decentralized and incoherent research and innovation policy system	(None; quite the opposite: HEI autonomy strengthened in 2010)	(Not applicable)
5. Poor incentive structures for starting firms compared to regular employment	No political will to radically change this; political ambitions to lessen the burdens for SMEs have produced investigations and projects to reduce red tape	Red tape reduction attempts appropriate but probably insufficient to truly meet the challenge; efficiency and effectiveness difficult to assess

4. NATIONAL PROGRESS IN INNOVATION UNION KEY POLICY ACTIONS

4.1 Strengthening the knowledge base and reducing fragmentation

4.1.1 Promoting excellence in education and skills development

Sweden performs above EU-27 average in the number of researchers as share of the total economically active population in the age group 25-64, as defined in the 1995 OECD Canberra Manual (OECD 1995) and counting people having successfully completed tertiary education and/or in occupations normally requiring completion of such education. The Swedish figure for 2012 is 52.6%, which is the fifth largest in the EU (after Luxemburg, Finland, United Kingdom and Denmark; outside of the EU also Switzerland and Norway score higher than Sweden) and a significantly higher figure than the average of 42.9% across the EU-27 countries (Eurostat 2013).

The overall unemployment rate in Sweden in 2012 was 8.0%, which is a typical figure in recent history (the past 20 years) and somewhat lower than the EU-27 average of 10.5%. The Swedish unemployment rate in the population aged 25-64 and with completed tertiary education is significantly lower than the overall, namely 4.0% in 2012, which is also somewhat lower than the 2012 EU-27 average of 5.6% (Eurostat 2013).

None of these figures have fluctuated heavily during the past ten years, which again is testament to the appropriateness of the general supposition that Sweden has been left relatively untouched by the global financial crisis and the Euro crisis (see section 2.1).

There are little or no signs that any active policymaking is imminent in the area of career paths of researchers in the public R&D system and the alleviation of obstacles to immigration of highly skilled labour. Both issues have, however, been the subject of some recent debate that was mainly provoked by an independent evaluation of the career trajectories in the higher education sector, which pointed out severe weaknesses of the system in international comparison (Benner and Öqvist 2012). It has also recently been suggested that a governmental evaluation be put in place to assess the prospects of extending the so called 'expert tax' (the lower tax rate for temporary foreign workers in knowledge-intensive sectors) to broader layers of the R&D sectors. This suggestion has also generally elevated the awareness of issues relating to the supply of skilled labour for the national R&D system (Björklund 2012).

The strong prioritization in current research policy and public R&D funding, shown in the 2008 and 2012 research bills (see section 1) have been followed by some attempts to further promote education in engineering fields in order to strengthen long-term competitiveness (Swedish Government 2009), but the education system is still based on strong principles of students' freedom to choose subject areas and study lines which means that some imbalances of supply and demand of highly skilled labour is built into the system.

4.1.2 Research Infrastructures

The Swedish national policy for research infrastructures (RIs) is under intense restructuring. Although relatively small and rather peripheral in Europe, Sweden has been strongly involved in collaborations around transnational research infrastructures in Europe in the second half of the 20th century. Until just recently, Sweden has never actively sought to host any major European RIs but rather kept its national RIs at a small scale, arguably appropriate for the size of the country, yet high-performing. In 2007, however, the Swedish government publicly announced its candidature to host the European Spallation Source (ESS) and build it in Lund, Sweden, and a simultaneous grassroots movement promoted the next-generation synchrotron radiation facility MAX IV in Lund as an international collaboration. In the spring of 2009 Lund emerged as the likely future location for both the ESS and the MAX IV facilities, bringing a need for investments for RIs at an unprecedented level in the Swedish domestic R&D budget (Hallonsten 2012). MAX IV is currently under construction, funded and organized by a consortium of the Swedish Research Council, Vinnova, the Regional Authorities of Skåne, and Lund University, and with a stated goal of bringing foreign investments in to complement the domestic commitment. The ESS, on its part, has only 50% of its construction budget covered, by the governments of Sweden (35%), Denmark (12.5%) and Norway (2.5%), and is thus far from start of construction, and the Swedish government continues its negotiations with other European countries to cover the remainder of the investment; negotiations that have now entered their fifth year. With MAX IV under construction and the ESS negotiations unresolved, and with these two projects potentially monopolizing Swedish budgets for RIs for several years (or even decades) to come, it is fair to say that Swedish RI policy regarding both domestic infrastructures and international collaborations is in a state of radical change whose full effects remain to be seen. The room for assessment of Swedish policy objectives, financial commitments**,** and national support for RIs, on several levels and in several dimensions including access, new initiatives and funding patterns, is severely restricted and has to be postponed until the results of the current radical change can be seen and the policy field returns to a more typical state.

4.2 Getting good ideas to market

4.2.1 Improving access to finance

The Ministry for Enterprise, Energy and Environment, through the evaluation commissioned to the OECD (see section 2.6), and the Ministry for Education and Research, through its main policy documents the 2008 and 2012 research bills, have identified similar key structural deficits in the Swedish innovation system. These can be summarized as follows.

- A historical division of labour between public R&D, funded by the state and carried out by the higher education sector and mostly 'basic' in its nature, and private sector R&D which is dominated by applied research and development carried out primarily in a handful of very large MNCs.
- A related dominance of large MNCs in the industrial sector, due to financial policy of the 20th century, and a relative lack of venture capital and other critical resources for innovation in SMEs.
- An entrepreneurial climate posing significant challenges to firm start-up compared to regular employment, generally consisting of inadequate incentive structures (Melin et al 2012).

While policy formulation at the Ministry for Enterprise, Energy and Environment in the area is rather vague and deals with establishing a strategic framework rather than launching concrete reforms, as shown in the 2012 National Innovation Strategy (Swedish Government 2012c), the Ministry has been able to launch some measures to mitigate the problems, including some efforts to reduce the red tape for SMEs. On December 4, 2013, the government decided to go ahead with its recently proposed project to reduce the required paperwork in companies' contacts with authorities under the name "one door in" (Swedish: "en dörr in"). In its current phase, the project is expected to deliver an online solution for a significantly simpler procedure that is supposed to replace and reduce red tape, evaluate which agencies and governmental authorities should be part of this solution, and work out a reasonable time frame. This phase of the project is set to conclude on June 4, 2014 (Swedish Government 2013d). The research bills of 2008 and 2012 have proposed a number of new policies to correct imbalances and increase private R&D investment, such as instruments that promote increased provision of venture capital, strengthening of Intellectual Property Rights (IPR), strengthening of the research institute sector, investments in new strategic innovation areas, and the initiative to establish 'innovation offices' at the major universities (Swedish Government 2008a; Swedish Government 2012b).

4.2.2 Protect and enhance the value of intellectual property and boosting creativity

Apart from the policy measures of the 2008 and 2012 research bills, mentioned in the previous section, there is little concrete policy to report on that concerns intellectual property. Governmental strategy documents discuss the long-term importance of reforms in the area, and Sweden is member of the European Patent Office, but there are few signs of any practical legislative changes in the near future.

4.2.3 Public procurement

The national innovation strategy, issued by the Ministry for Enterprise, Energy and Environment in October 2012, puts great emphasis on the role of public procurement in supporting and enhancing innovation. The strategy defines the role of public procurement in the area as twofold; innovation-friendly procurement, which is inclusive and facilitates the use of new solutions, and procurement of innovation, by which is meant procurement of entirely new solutions not previously on the market (Swedish Government 2012c).

As previously mentioned, the 2012 national innovation strategy is a visionary document more than a set of concrete policy measures, and the implementation of the policies so far has, as mentioned in a previous section, focused on the strengthening of business incubators and the outline of a future evaluation standard for the innovation strategy. The government has, however, worked for several years with an active strategy to support public procurement of innovation, through a program managed by Vinnova since 2006. In its first years, the program focused mainly on policy formulation, investigations and small-scale pilot projects, but in 2011, Vinnova launched an innovation procurement program that was followed, in 2012, by a substantial increase of the support to the program of approximately €2.5m, followed up by approximately €1 m yearly (Olofsson 2011). The conclusions of a governmental investigation, which submitted its final report in 2010, lays the foundation for the targeted investment and the Vinnova program: There is a great need for increased knowledge and change of attitudes among public actors that can increase the demand for new and better solutions in a variety of areas. The *public procurement of innovation program* at Vinnova is consequently focused on support functions and training of personnel in the public sector (Vinnova 2012).

4.3 Working in partnership to address societal challenges

There are little or no signs of any Swedish participation in European Innovation Partnerships induced at national (policy) level. Vinnova comments upon the program on their website, essentially providing a summary in Swedish of the objectives and structure of the partnership program, but provides no clues on how the European Innovation Partnerships program is to be implemented in the Swedish context.

The participation of Swedish publicly funded R&D in cross-border collaboration is certainly high, and has most likely been enhanced by the Swedish EU membership and the possibilities offered by participation by Swedish university researchers and private sector R&D units in Framework Programme activities, but the interaction remains largely dependent on spontaneous initiatives on grass root level, and is hence difficult to assess in terms of the existence of any national coherence.

The national Swedish research and innovation policy is clearly aimed at mobilization in some key areas and targeting grand societal challenges, but the policy essentially remains a Swedish domestic issue, as shown in the 2008 and 2012 research bills (reviewed elsewhere in this report).

4.4 Maximising social and territorial cohesion

As noted in a previous section, the Swedish work with implementation of the Regional/National Research and Innovation Strategies on Smart Specialisation (RIS3) has not reached any stage of tangible results or even hints of how the strategies are to be let to influence Swedish work with regional specialization.

4.5 International Scientific Cooperation

The Swedish government's research and innovation policy is almost exclusively geared towards increasing Swedish national competitiveness in a European as well as global context, and internationalization strategies appear mostly to be secondary effects of policies with partly different sets of aims. Mentioned in this context can be the recent so-called Autonomy Reform of the Swedish academic system that has brought increased liberty to university and higher education institution leadership and management to structure the governance of their organizations. It is likely to have some effects on mobility of researchers and the openness of the Swedish system to foreigners. It is important to note, however, that the purpose of the reform was to strengthen self-governance in order to secure academic freedom which is believed to generally enhance quality. Possible positive effects on mobility and internationalization are rather indirect than purposive. Transatlantic mobility has not been particularly addressed by this or any other reform.

In the 2012 research bill, as part of the general quality enhancement ambitions of the current governmental research policy in Sweden, a specific program was launched to incentivize the HEIs to make international recruitments of especially "prominent" researchers. In the bill, the annual governmental grant to the Swedish Research Council is increased with an earmarked amount of 150 million SEK (€ 18 million) in 2013, followed by increases of 50 million SEK (€ 6 million) in 2014 and 2016 to be spent on a program – designed an launched by the council – "for the international recruitment of researchers who conduct research of the highest quality."

(Swedish Government 2012b). The program was launched in the spring of 2013, and as of December 2013, four internationally renowned professors had been recruited to three Swedish universities as part of the program (Swedish Research Council 2013b).

5. NATIONAL PROGRESS TOWARDS REALISATION OF ERA

5.1 More effective national research systems

As noted in previous sections, the Swedish public research and innovation system is dominated by national governmental funding on the supplier side and the higher education institutions on the performer side. The research income in the HEI sector from governmental sources is split almost equally between institutional block grants and competitive project funding which are both in steady increase. The institutional block grants are largely distributed on basis of tradition, that is, on basis of historical patterns, which means that the 11 largest universities consume an average of 89% of the annual institutional block grants in the past five years, with the 18 newer university colleges sharing the rest (Hallonsten and Holmberg 2013).

Recent efforts by the government to make large parts of their real increase of the block grant funding subject to allocation on basis of performance evaluation is currently being implemented, and will likely reinforce this structural division of the academic system, since it is generally the larger universities that are well-performing. The same can probably be said about the new special funding programme launched by the Swedish Research Council on charge from the government, aimed at supporting the recruitment of world-leading scientists to Swedish universities as an effort to strengthen some especially promising research environments. The 2012 research bill introduced a general funding increase of almost 4 billion SEK until 2016 (Swedish Government 2012b). The exact results of these efforts remain to be seen, as the policies are quite new.

The most recent, and reasonably most significant, move towards an internationalization of peer review as a process for the allocation of research funding is the sharp shift of governmental research funding policy in the 2012 research bill, from bibliometric assessment to international peer review evaluation. In practice, this applies to the share of governmental institutional block grant funding allocated in a competitive scheme, which is roughly 10% of the overall annual block grants, although a doubling of this share to 20% is envisioned for the coming years. The system and the procedure is however only vaguely described in the bill, and the Swedish Research Council has been charged with designing the system in all its specifics so that it can be implemented in 2018, at the earliest (Swedish Government 2012b). The previously launched excellence funding schemes (the Linnaeus Grants of 2005-2015 and the Strategic Research Areas of 2009-2019) also meant a partial increase of the role of international peer review assessment of funding applications in the public Swedish R&D system.

5.2 Optimal transnational co-operation and competition

The Swedish government, under its Presidency of the Council of the European Union in the second half of 2009, took the initiative and planned the conference *New Worlds – New Solutions – Research and Innovation as a Basis for Developing Europe in a Global Context* that took place in Lund on July 7–8, 2009. In spite of this leading role in the conference and its resulting main document the Lund Declaration, the Swedish government has made little or no policy efforts to directly address the challenges named in the declaration, although several of the recent policy measures adopted by the government (see below, this section) are closely related to those actions there proposed. Not least has the current Swedish government adopted a policy language – also partly reflected in its concrete policy priorities – that clearly favours the "strengthening of frontier research initiated

by the research community itself", attempts to "bring together supply- and demand -side measures to support both business development and public policy goals", and the "creation and maintenance of world class research infrastructures", all three key points in the Lund declaration. The rhetoric as well as the measures is, however, almost exclusively anchored in rather nationalist policy formulation; the fundamental rationale for any Swedish governmental research and innovation policy is to strengthen Swedish national long-term competitiveness, also to fare better in contests with neighbouring countries and their R&D institutions and knowledge-intensive industries. As also noted in previous sections, Swedish governmental research and innovation policy almost exclusively relies on the analysis that the competitiveness of the Swedish national economy (and, by extension, society) hinges upon a strengthening of the Swedish national research and innovation system, and an associated determination on behalf of policymakers to take action to secure this competitiveness. In a sense, this means that the policy measures taken indeed are designed partly taking into account the policies of other European countries, and the 20 Strategic Research Areas, identified in the 2008 research bill and endowed with a specific funding program allocating a total of €300m to 43 research environments in Swedish universities have been identified as highly relevant also in broader European perspective (Swedish Government 2008a). It is important to note, however, that the role of the Swedish research and innovation system in strengthening the long-term common European competitiveness is downplayed, not to say straightforwardly neglected, in governmental research and innovation policy, in favour of national considerations. Those comparably large investments being made in research infrastructure (the European Spallation Source, ESS, and the MAX IV synchrotron radiation facility in Lund, and the Science for Life Laboratory, SciLifeLab, in Stockholm/Uppsala) are certainly of European interest (especially in the case of the ESS) but the investments are clearly made on basis of priorities with Swedish national competitiveness in mind. Especially the SciLifeLab investment is partially a direct response to AstraZeneca's closing of its R&D facility in Södertälje south of Stockholm in 2011, which significantly redrew the map of the regional life sciences innovation system in the Stockholm/Uppsala region (Swedish Government 2012a).

As mentioned, the allocation of competitive public R&D funding in Sweden (mainly executed within the framework of the research councils) typically follow the procedure of internal peer review assessment boards with predominantly Swedish or Scandinavian members. The involvement of international peer reviewers in funding decisions is hence limited, however, in recent years; two specific policy measures have been taken that deviate from this typical pattern. First, the allocation of funding within what is typically identified as the 'excellence' funding programs, i.e. the 2006 and 2008 Linnaeus Grants and the aforementioned 2009 Strategic Research Areas grants (allocating in total €30 m and €300 m, respectively) (Swedish Government2008a, 2012b; Hallonsten and Silander 2012). These funding programs involved the use of international peer reviewers in the process of choosing grant recipients. Second, the aforementioned new assessment scheme introduced in the 2012 research bill, which will replace the current bibliometric scheme for the redistribution of approximately 10% (eventually 20%) of the total annual institutional block grants. This peer review scheme is supposed to make use of internationally composed review panels; however, as mentioned, the scheme is however only vaguely described in the bill, and will be laid out in detail in the coming years and implemented (at the earliest) in 2018 (Swedish Government 2012b).

The Swedish national policy for research infrastructures has been, and is still, in a phase of intense restructuring. Given its relatively small size and rather peripheral position in Europe, Sweden has been exceptionally strong in science and not least big science in the second half of the 20th century, as seen in its record of contributions and participation in European

collaborations in research. But Sweden has, up until a decade ago, not been actively seeking to become host of any of these collaborations, and the national facilities, at its height five in number, were all domestic and comparably small-scale (though allegedly strong in scientific and technical performance), run as departments of their respective host universities but with a specific status as national laboratories. This changed radically when in 2007, the Swedish government publicly announced its candidature to host the European Spallation Source (ESS) and build it in Lund, Sweden. Simultaneously, a grassroots movement had promoted the next-generation synchrotron radiation facility MAX IV in Lund. On basis of a heavy lobbying effort, in the spring of 2009 Lund could emerge as the likely future location for the ESS and the MAX IV facilities, which means that investments on completely unprecedented scale in the Swedish public research system are being made in accelerator facilities in Lund. These investments were decided upon by the government (the ESS) and by a consortium of the willing (MAX IV), thus partly sidestepping the long-term planning and evaluation effort of the Swedish Research Council formalized in its National Roadmap for Research Infrastructures. The fate of the ESS plans is still not completely determined, as the only binding funding pledges made are those by Sweden, Denmark and Norway, covering 50% of the construction costs, and with the negotiations with other prospective European member countries entering their fifth year (Hallonsten 2013a). MAX IV, on the other hand, is currently being constructed in Lund. Despite being set for opening in 2015, the legal status of the MAX IV facility is still not settled, as ownership is shared between several actors and some inflow of foreign capital is also expected. On December 16, 2013, the Swedish Research Council decided to allocate a total of just over 150 m€ for the operation of the MAX IV facility for the years 2013-2018, which ended some of the uncertainty regarding the future of the facility (Swedish Research Council 2013a). With regard to the ESS, the situation is significantly more complicated, as funding and organizational issues are still to be resolved – only half of the construction costs are currently covered and the future operations costs have still not been discussed (see e.g. Hallonsten 2013b). On basis of all this, it suffices therefore to say that with regard to policies for the construction and operation of large research infrastructures in Sweden, the past few years have seen dramatic change that is still ongoing and the full effects of which remains to be seen, for the Swedish research policy system and more specifically, for Sweden's policy regarding international and national research infrastructures. The room for assessment of details of access to RIs is therefore limited and need to be postponed until changes have occurred or, at least, decisions have been made with regard to the organization and legal status of MAX IV, ESS and SciLifeLab, and in the case of ESS, with regard to its realization – the future of ESS and the nature of the facility in terms of organizational and legal status (international treaty organization, limited liability company, etc.) and distributions of shares or similar among member countries will doubtlessly affect not only the access to ESS by foreign scientists but also generally. Besides this, it can be said that the existing MAX-lab facility in Lund is a member and active voice in the ERF – European Association of National Research Facilities, an organization with a stated purpose to "promote cooperation between individual European national large-scale research facilities laboratories" which includes the removal of barriers to access for researchers (ERF 2013).

5.3 An open labour market for researchers

The current centre-right coalition government has undertaken a certain shift in policy formulation (and to some extent concrete reforms) of the internationalization aspects of the Swedish public research system, as seen both in the two recent research bills (2008 and 2012) and in some bills there between, most of all perhaps the 2010 structural reform of the organizational independence of the universities and other higher education institutions (HEIs), invoking what has popularly become called the Autonomy Reform. This bill had a clear ideological foundation,

as it communicates an ambition of achieving a better practical manifestation, in the organizational autonomy of the institutions, of the traditionally strong and essential independence of research and higher education in society. As part of this reform, the HEIs were given a far-reaching autonomy in determining their own procedures for hiring and promotion of academic staff. Importantly, this meant a formal end to the rather detailed regulation of hiring and promotion procedures in the Swedish academic system, including a new right of the HEIs to call individuals to specific positions, thereby shortcutting the previous and normally predominant system of open competition, a reform which is motivated by the wish to give the Swedish HEIs better means to compete internationally for talent (Swedish Government 2008b). Clearly, these reforms have general significance for research mobility across the border to Sweden, however, since the so-called autonomy reform is one granting greater independence to the HEIs rather than stipulating new procedures, there is no guarantee that the reforms have any concrete impact on mobility. It is, hence, still unclear to what extent the autonomy reform has actually led to changes in practice; this will have to be the subject of separate ex post evaluation of actual cases. As a kind of follow-up to the 2010 Autonomy Reform, the government made a suggestion in 2013 that universities and higher education institutions be given the future opportunity to reconstitute to a new kind of organizations based on the model of foundations, in order to increase their autonomy further and as a consequence strengthen their international competitiveness (Swedish Government 2013a). Before amounting to a legislative reform, however, the suggestion will have to pass the customary referral process and subcabinet level preparation.

Another recent policy measure will most likely have a more direct and measurable effect on the mobility of scientists across the boundary to Sweden. In the 2012 research bill, as part of the general quality enhancement ambitions of the current governmental research policy in Sweden, a specific program was launched to incentivize the HEIs to make international recruitments of especially "prominent" researchers. In the bill, the annual governmental grant to the Swedish Research Council is increased with an earmarked amount of 150 million SEK (€ 18 million) in 2013, followed by increases of 50 million SEK (€ 6 million) in 2014 and 2016 to be spent on a program – designed an launched by the council – "for the international recruitment of researchers who conduct research of the highest quality" (Swedish Government 2012b). The program was launched in the spring of 2013, and as of December 2013, four internationally renowned professors had been recruited to three Swedish universities as part of the program (Swedish Research Council 2013b).

The aforementioned autonomy reform for the Swedish academic sector was less of a specific policy reform and more of a general loosening of regulation. Granting greater organizational freedom to the HEIs, including liberties to change the procedures for hiring and promotion of academic staff, this autonomy reform does undoubtedly impact mobility on almost all levels and in almost all instances; vacancy announcements (including job profile, skills and competences required, and eligibility criteria); the selection process and criteria; time periods for various stages in the recruitment process; possible feedback to applicants; routines for appeals against decisions; and the composition of selection panels as well as rules for the composition and publication of the composition of panels. However, since the reform granted the HEIs increased freedom and not explicitly changed the procedures in any direction, it is difficult to assess the effects. This will be done in future governmental investigations and will thus have to be returned to in due time. It is, however, reasonable to suspect that the autonomy reform can have a slightly harmful effect on the transparency of the recruitment processes as universities, by this reform, have been given the freedom to also call individuals to specific posts, thus short-circuiting the typical open recruitment process. The recruitment of world-leading scientists to Swedish universities (see previous paragraph) has produced a rather meagre result – only four recruitments made, see

above – which speaks against any significant effect of this policy for the reducing or removal of barriers generally.

The past years have seen no new legislative or policy efforts on national level to alter cross-border access to and portability of national grants. First-stream funding to universities are naturally tied to specific institutions. Third party grants are generally flexible in that they can, once granted and commenced, be transferred across national borders to foreign institutions; however, it is typically the case (as for Swedish Research Council grants) that applicants must, in order to be eligible for a grant, localize the grant to a Swedish institution to which the funding will be disbursed by the funding agency and which will act as employer of the grantee.

In Sweden, the EURAXESS network is represented by a website portal, launched in mid-2011, designed to provide information to foreigners and swedes alike about possibilities and practicalities in association with researcher mobility. The website is connected to a network of 50 local nodes at universities and other higher education institutions, research councils, research institutes and firms. The administration of EURAXESS in Sweden lies with the Swedish Agency for Innovation Systems (Vinnova) and the Swedish Research Council, the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas) and the Swedish Council for Working Life and Social Research (FAS). The EURAXESS network is thus not subject to any national coordinated policy effort but rather administered and sustained by these research councils and the participating institutions. There is no mentioning of EURAXESS in the two most recent governmental research bills (2008 and 2012), or in the governmental innovation strategy launched in October 2012.

There are no policy efforts on national level in Sweden that are tailored to directly address the Innovative Doctoral Training principles. However, as mentioned before, the current state of research policy in Sweden, including the issue of doctoral training which is an important part of the public R&D effort (consuming a significant share of the governmental R&D appropriations to the academic sector) is such that the seven principles in question are given specific attention in legislation and policy documents on governmental level. Especially Research Excellence, Attractive Institutional Environment, Exposure to industry and other relevant employment sectors and Quality Assurance are stated hallmark principles for governmental research policy generally and thus also more specifically for doctoral training, although it is debatable how much practical policy reform along these lines that is at all possible given the structure of the system (see above). Also the principles Interdisciplinary Research Options, International networking and Transferable skills training are, to some extent, possible to identify as part of governmental R&D policy, albeit to varying degree subject to practical policy.

There are no coordinated efforts on national level (government or agencies) to enable the implementation of the HR Strategy for Researchers; this is, just as many other issues of human resources and mobility, left to the academic sector and its institutions to sort out by themselves.

5.4 Gender equality and gender mainstreaming in research

Interestingly, in spite of the general Swedish strong showing in international rankings and evaluations of gender equality and equal opportunities policy, the recent few years' policy initiatives on national level aiming to boost excellence and quality in the public R&D system have had little involvement of policies aimed at providing equal opportunities in academia and thus end the waste of talent (and, by extension, waste of excellence) brought by gender inequalities institutionalized in academic culture. The 2008 research bill mentions gender inequality once

(other than in connection with gender studies as a field of academic study), stating that the work to achieve better gender equality in the research system "continues to be a priority" for the government but with no reference to concrete policy measures in the area (Swedish Government 2008a). The 2012 research bill mentions gender inequality once, and limits itself to instructing the universities and higher education institutions to intensify the work to break gender bias in education efforts (Swedish Government 2012b). In the previously mentioned Autonomy Reform bill, the liberalization of certain regulations for academic institutions includes the opportunity for universities and higher education institutions to give a candidate from an underrepresented gender priority in recruitments (Swedish Government 2008b).

However, despite this relative silence regarding gender (in)equality in in governmental policy, there are signs that the current excellence policy doctrine in its practical manifestations have had some effect on gender balance in the academic system, although apparently to the negative. An evaluation of the excellence funding programs (the Linnaeus Grants and the Strategic Research Areas, among others, all discussed above) by the so-called Delegation for Gender Equality in Higher Education has pointed out that although the effect is likely both unplanned and undesirable from the policymakers' parts, these excellence funding programs have had adverse effects on gender equality, essentially solidifying and aggravating existing structures, which means promoting already successful male researchers at the expense of their female colleagues. It has been shown that excellence funding programs of this sort in practice mostly gain the already successful – who, more often than not, are male – and also accentuate those existing inadvertent gender inequalities that seem to be institutionalized in the foundational peer review systems of practical research policy (Sandström et al 2010). Thus while in direct policy formulation and implementation, the government appears rather passive on the area of gender balance in the research system, it seems some of its other policies work against gender equality when practically implemented, although this is likely unplanned and undesired given Sweden's otherwise strong showing in gender equality policy.

The past ten years have seen some upswing in gender research in Sweden, and the field has gotten significant attention not least in targeted funding programs among the research councils. The Swedish Research Council's general call for project grant proposals does, for example, specifically request information on whether gender aspects are included in the research questions and topics of applications; however, it is not clear to what extent this is considered a merit in the evaluation of application or whether it is used merely for generating statistical indicators.

In the late fall of 2013, the government charged its agency The Swedish Agency for Public Management with the task of investigating the overall gender balance in publicly funded research in the higher education sector, institutional first-stream funding and competitive grants alike. The task also involves a qualitative study of assessments of grant and job applications in gender perspective. The result of this investigation (no date has been set for its completion) will likely form the basis of several policies in the years to come (Swedish Government 2013e). The committees involved in the recruitment of academic staff in the Swedish academic sector are, by law, required to have gender balance. This regulation has remained in place also after the implementation of the aforementioned 2010 so-called Autonomy Reform which otherwise deregulated several similar procedures within academic institutions.

5.5 Optimal circulation, access to and transfer of scientific knowledge including via digital ERA

In terms of governmental policy, the 2012 research bill took one step towards institutionalization of the open access principle in the Swedish public R&D system, by giving the Swedish Research Council the task of developing structures and "national guidelines" for the access to research results and data for researchers. This work is not yet concluded and there has been no date specified for the delivery of results therefrom (Swedish Government 2012b). Generally, the Swedish public R&D system is oriented to the international system of results circulation in peer review-based English-speaking journals owned and run by multinational publishing houses. Although there is a clear growth in the number of online, open access, journals among the ones preferred by the scientific community, open access publishing still, in most cases, requires the author to pay a fee for review and publication in order to make the article freely available. Swedish universities spend large and growing sums of money on institutional subscriptions to the non-open journals, and this is considered a potential structural problem since the subscription costs only seem to grow for every year. The government has, consequently, adopted a strongly articulated policy that favours open access publishing and comprehensive efforts in the system to facilitate a great relative increase in open access publishing in the Swedish universities. The motivation is a considered opinion on behalf of the government that long-term competitiveness in the Swedish R&D system, and by extension, Sweden's innovative capacity, hinges upon easy and timely access to scientific information and publications. In terms of concrete policy measures, however, the government largely leaves the initiative to the universities and other actors in the system. Acknowledging that there is active work among the universities and higher education institutions as well as various research funding organizations and the Royal Library towards a "model for free access to scientific information", the government is largely content with commending and encouraging this effort (Swedish Government 2012b: 151).

Since 2010, the Swedish Research Council, the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas), the Swedish Council for Working Life and Social Research (FAS), the Bank of Sweden Tercentenary Foundation (RJ), the Knut and Alice Wallenberg Foundation (KAW) demand that their grantees publish their results with open access. Almost all Swedish universities and higher education institutions have open, searchable databases where publications are listed and in many cases online versions of publications are openly accessible.

The strong policy standpoint in favour of open access publishing articulated in the 2012 research bill is directly connected to the EU guidelines in the area. The Swedish government subscribe to the view, expressed by the Council of the European Union in November 2007, that the publications emanating from publicly funded R&D activities should be openly available online, at no cost for the reader. Later recommendations by the European Commission are also mentioned in the bill and the government is clear on the point that it is its ambition to work towards the implementation of these EU-level recommendations (Swedish Government 2012b: 150). As noted above, however, little concrete policy measures are introduced in the bill. The government seems largely content in leaving to the universities and higher education institutions, the various funding agencies in the system, as well as the Royal Library (who all have taken measures of their own in favour of open access), to execute the policy on their own terms. In the case of the Swedish Research Council, the largest third-party funder of research in the public system in

Sweden and also the government's main agency for policy development and execution, the instruction is clear: The council is directly charged with the task of developing national models and recommendations for the increased reliance on open access publishing in the system. No further details are given.

The initiatives on EU level to build up research infrastructures for the facilitating of dissemination of data and results (e.g. European Social Survey, CESSDA, SHARE) are supported by the Swedish government who take active part as members in these initiatives and thus secure the access for Swedish researchers to them.

One of the main initiatives launched by the government in its 2012 research bill was a broad effort to strengthen the interaction between the public R&D system (academia) and private enterprise. This initiative was, in part, articulated as an answer to a long-since identified structural deficiency in the Swedish research and innovation system usually named the "Swedish Paradox" and also a direct response to the recommendation to Sweden by the Council of the European Union, issued on 30.05.2012, that the research bill should be focused on "measures to improve the commercialisation of innovative products and the development of new technologies to support high-growth innovative firms." The initiative can be divided in four major actions. (1) Strengthening of the industrial research institutes, which operate in the borderland between academia and industry and work to enhance knowledge and competence in innovation, by a substantial funding increase. In addition, the governmentally owned holding company called Research Institutes of Sweden (RISE), who coordinate the publicly funded research institutes, are instructed to work purposefully towards better coherence among institutes within industrial sectors, streamline the institutes' legal and organizational structures, strengthen its own brand to increase recognition, deepen its collaborations with both academia and industry, increase its financial support to innovation activities in SMEs, and strengthen its in-house competence in intellectual property. (2) Support of efforts in the academic sector to interact with society and commercialize results, by a funding increase directed to efforts of strengthening the "innovation offices" at the universities and higher education institutions. These "innovation offices" support academic staff in their efforts to commercialize their results. (3) Strengthening of the innovation infrastructure, by a resource increase to the Swedish Agency for Innovation Systems (Vinnova) directed to the increase of the availability of technical facilities for testing and validation within the institutes of RISE. (4) Ongoing work to modify patent rights and the deductibility of donations to R&D. This is work in progress and has not reached any concrete stage (Swedish Government 2012b: 119-142).

The potential of governmental policy efforts to enhance or support the flow of information in scientific communities is limited, regardless if it concerns the public or private R&D systems. Governmental policy in this area does not go beyond what has been written in the 2008 and 2012 research bills in support of efforts, conducted on agency level, to facilitate open access publishing and publicly available online information databases. As noted, the 2012 research bill also took an active stand in the shape of issuing a task to the Swedish Research Council to develop and suggest national guidelines and standards (see above).

Two national initiatives, none of them the result of direct governmental policymaking but rather collaborative efforts between public and private national organizations (agencies and foundations), deserve mentioning in this context. First, the SwePub database, which is run by the Royal Library and indexes articles, conference papers and doctoral dissertations published by researchers at Swedish universities and higher education institutions (all institutions except the Stockholm School of Economics are part of SwePub). Second, the OpenAccess.org project, run

and funded by the Royal Library in collaboration with the Association of Swedish Higher Education (an voluntary interest organization for Swedish universities and higher education institutions), the Royal Academy of Sciences, and the Knowledge Foundation (a public research foundation). Within this project, the collaborators work with information and counselling, infrastructure and services, and policy development regarding open access publishing.

Annex 1. PERFORMANCE THE NATIONAL AND REGIONAL RESEARCH AND INNOVATION SYSTEM

Feature	Assessment	Latest developments
1. Importance of the research and innovation policy	(–) Swedish national research and innovation policy has long suffered from incoherence and fragmentation (+) Strategic prioritization has been enhanced in the three most recent research and innovation bills (2004, 2008, 2012)	(+) Latest research and innovation bill continues governmental efforts to strengthen Swedish R&D in areas of national strategic importance (–) Policy measures are judged inadequate by many commentators
2. Design and implementation of research and innovation policies	(+) Quadrennial research and innovation bills are produced on basis of broad input from several agencies and all universities and HEIs, and based largely on consensus, with a few exceptions (–) Consensus culture curtails truly effective policy reforms by the government (–) Monitoring and review incoherent and based on opaque criteria	(–) Autonomy reform of HEIs put more power in the hands of university leadership which furthers incoherence and plurality in the system
3. Innovation policy	(+) Innovation recognized as highly prioritized for Swedish long-term competitiveness; policy language is generally very innovation-oriented (–) Some lack of correspondence between rhetorical acknowledgement of the importance of strengthening innovation and practical policies; the latter significantly underdeveloped	(+) National innovation strategy presented in late 2012 (–) National innovation strategy is mainly a general idea document; few or no concrete policy measures yet seen
4. Intensity and predictability of the public investment in research and innovation	(+) Public investments in education, research and innovation are prioritized in national governmental budget (–) Little or no concrete efforts to break the strong boundaries between the public and private R&D systems; private sector investment in public R&D is low, as are public-private-partnership activities.	(+) Private investment in academic R&D increasing slightly; albeit not because of any policy reforms
5. Excellence as a key criterion for research and education policy	(+) Several new excellence-based funding programs launched in three most recent research and innovation bills (–) Swedish public R&D system (academia) often accused of academic inbreeding	(+) Broad trend of internationalization of proposal review panels on several levels
6. Education and training systems	(–) General debate (public as well as among experts) criticize Swedish primary, secondary and tertiary education for deteriorating quality; lack of consensus on causes and mechanisms due to a gridlock in the political debate in the area and a lack of comprehensive evaluative measures	(–) Recent PISA evaluation shows radical decline in results in Swedish elementary schools; similar yet smaller and domestic evaluations of tertiary education also convey pessimistic views
7. Partnerships between higher education institutes, research centres	(–) Strong historically determined structural division between HEI sector and private sector (+) Efforts since the mid-1990s to strengthen academy-industry interaction (launch of public research foundations as well as Swedish Agency for Innovation Systems)	(+) Two most recent research and innovation bills makes comprehensive efforts of facilitating greater academy-industry

and businesses, at regional, national and international level	(–) Tax code and other incentives structures often judged inappropriate for nurturing academy-industry interaction and knowledge-based entrepreneurship	interaction, by e.g. strengthening research institute sector
8. Framework conditions promote business investment in R&D, entrepreneurship and innovation	(–) Private side of the R&D system dominated by a few very large MNCs, which creates a huge structural obstacle towards the promotion of innovation; large MNCs are largely untouched by national policies and the general situation for SMEs is unfavourable	(+) Political acknowledgement of the structural challenges in recent policy documents and bills (–) Few and inadequate concrete measures to meet the challenges and overcome structural obstacles
9. Public support to research and innovation in businesses is simple, easy to access, and high quality	(+) Those programs available (via e.g. Vinnova) are simple, easy to access and of high quality (–) Real-terms benefits of these programs difficult to assess	(No recent developments)
10. The public sector itself is a driver of innovation	(+) Awareness of the importance of public procurement of innovation (–) Legislation on public procurement recurrently criticized for rigidity and for on-sided favouring of lowest bidder rather than highest quality	(No recent developments)

Annex 2. NATIONAL PROGRESS ON INNOVATION UNION COMMITMENTS

		Main changes	Brief assessment of progress / achievements
1	**Member State Strategies for Researchers' Training and Employment Conditions**	(none)	(+) Swedish higher education system is well built-out; over 50% of every cohort proceeds from secondary to tertiary education
4	**ERA Framework**	(+) University autonomy reform (+) Policies of 2012 research bill	(+) Potentially increased possibilities for foreign researchers to seek employment in Swedish public R&D sector (+) Increased transparency and competition in public research funding
5	**Priority European Research Infrastructures**	(+) Start of construction of MAX IV (-) No conclusion of international negotiations over funding for the ESS	(-) National stalemate due to heavy uncertainty regarding the future of the massive investments in the ESS, and some uncertainty regarding the future of MAX IV as an international (Nordic) project (-) Lack of active participation in the work of ESFRI on pan-European priorities due to aforementioned national stalemate situation
7	**SME Involvement**	(none)	(-) No particular initiatives at all
11	**Venture Capital Funds**	(+) Some awareness in national policy documents that reforms of tax code is necessary to enhance the venture capital market (+) Some minor programs launched by Vinnova and the Swedish Agency for Economic and Regional Growth	(-) Awareness on policy level not met by any concrete policy reforms whatsoever
13	**Review of the State Aid Framework**	(+) 2013 legislation implemented the EU transparency directive in Sweden	(none)
14	**EU Patent**	(+) Governmental investigation suggests Swedish ratification of the Agreement on a Unified Patent Court (-) No ratification yet	(+) Ratification of the Agreement on a Unified Patent Court likely imminent
15	**Screening of Regulatory Framework**	(none)	(none)
17	**Public Procurement**	(+) National program launched	(+) Awareness on governmental level

20	**Open Access**	(+) Demand that research funded by the Swedish Research Council be published open access only	(difficult to assess the effects at this point)
21	**Knowledge Transfer**	(+) National policy initiatives to strengthen institute sector (+) Launch of innovation offices at major universities (+) Vinnova program on Challenge-driven Innovation	(difficult to assess the effects at this point)
22	**European Knowledge Market for Patents and Licensing**	(+) Vinnova works with several programs providing support for patenting, trademarks, copyright, design rights and their commercial exploitation.	(no new policies or instruments)
23	**Safeguarding Intellectual Property Rights**	(none)	(none)
24	**Structural Funds and Smart Specialisation**	(+) Launch of collaborative project among all Swedish regional authorities, within RegLab, on how to proceed with Smart Specialisation.	(difficult to assess the effects at this point)
25	**Post 2013 Structural Fund Programmes**	(+) Eight regional and one national program formulated and proposed	
26	**European Social Innovation pilot**	(+) Social innovation programmes by Vinnova and the Swedish Agency for Economic and Regional Growth, also with involvement by Malmö University College	(none)
27	**Public Sector Innovation**	(none)	(none)
29	**European Innovation Partnerships**	(+) Swedish participation in expert group for the evaluation of the overall performance of the European Innovation Partnership concept and approach.	(+) Swedish participation in several recent meetings in expert group for the evaluation of the overall performance of the European Innovation Partnership concept and approach
30	**Integrated Policies to Attract the Best Researchers**	(+) Specific funding program launched in the spring of 2013 to attract internationally renowned scientists	(–) Limited success of program; only four scientists recruited as of December 2013
31	**Scientific Cooperation with Third Countries**	(+) Vinnova-led programs and cooperations with foremost China, India, Brazil, but also other countries, in innovation in specific sectors	(none)
32	**Global Research Infrastructures**	(+) Start of construction of MAX IV (-) No conclusion of international negotiations over funding for the ESS	(-) National stalemate due to heavy uncertainty regarding the future of the massive investments in the ESS, and some uncertainty regarding the future of MAX IV as an international (Nordic) project
33	**National Reform Programmes**	(none)	(none)

Annex 3. NATIONAL PROGRESS TOWARDS REALISATION OF ERA

ERA Priority	ERA Action Code	ERA Action	Recent changes	Assessment of progress in delivering ERA
1. More effective national research systems	MS01	Action 1: Introduce or enhance competitive funding through calls for proposals and institutional assessments	• 2008 research bill made parts (10%) of the block grant allocation to HEIs competitive (performance-based) • 2012 research bill increased the share of the block grant allocation to HEIs that is competitive (performance-based) to 20% • Launch of competitive Strategic Research Areas grants in 2008 and 2012 research and innovation bills	(+) Gradual increase of governmental block grants allocated in performance-based schemes (–) Reforms partial and reform pace slow
	MS02	Action 2: Ensure that all public bodies responsible for allocating research funds apply the core principles of international peer review	• General shift in governmental attitude away from bibliometric evaluation and towards qualitative international peer review	(+) Attitude shift positive (–) No comprehensive reform; change still hinges on initiative at lower levels of the system
2. Optimal transnational co-operation and competition	MS06	Action 1: Step up efforts to implement joint research agendas addressing grand challenges, sharing information about activities in agreed priority areas, ensuring that adequate national funding is committed and strategically aligned at European level in these areas	• Launch of competitive Strategic Research Areas grants in 2008 and 2012 research and innovation bills • Several similar 'strategic' and 'excellence'-based funding programs launched by other public and private funding bodies	(+) Strategic Research Areas grants a significant step towards strategic prioritization and mobilization in the system (–) Effects and efficiency of the Strategic Research Areas program and counterparts uncertain

	MS07	Action 2: Ensure mutual recognition of evaluations that conform to international peer-review standards as a basis for national funding decisions	• Competitively allocated governmental block grant funding to universities and HEIs will eventually be allocated on basis of an international peer review exercise	(+) Instruction given to Swedish Research Council to develop a scheme for international peer review panels for the allocation of block grant funding to universities and HEIs (–) Reform changing foundation for allocation of the block grant funding to universities and HEIs on basis of competitive scheme from bibliometric measures to international peer review will not be implemented until 2018, *at the earliest*.
	MS08	Action 3: Remove legal and other barriers to the cross-border interoperability of national programmes to permit joint financing of actions including cooperation with non-EU countries where relevant	(None)	
	MS15	Action 4: Confirm financial commitments for the construction and operation of ESFRI, global, national and regional RIs of pan-European interest, particularly when developing national roadmaps and the next SF programmes	• Large governmental commitments to contribute to the building of the ESS and MAX IV in Lund, Sweden	(+) MAX IV funding secured (–) ESS negotiations entering fifth year without results (–) Other ESFRI-prioritized projects neglected by Swedish government in favour of MAX IV and ESS
	MS16	Action 5: Remove legal and other barriers to cross-border access to RIs	• Active work to make the future ESS facility an ERIC which supposedly would facilitate cross-border access	(No recent developments)
ERA priority 3: An open labour market for researchers	MS24	Action 1: Remove legal and other barriers to the application of open, transparent and merit based recruitment of researchers	• 2008 autonomy reform granted universities and HEIs greater freedom to determine their own organizational structures, including HR	(+) Some universities may have implemented changes in favour of open, transparent and merit based recruitment of researchers (–) Some universities may have implemented changes that hurt the prospects of open, transparent and merit based recruitment of researchers
	MS25	Action 2: Remove legal and other	(None)	

		barriers which hamper cross-border access to and portability of national grants		
	MS26	Action 3: Support implementation of the Declaration of Commitment to provide coordinated personalised information and services to researchers through the pan-European EURAXESS3 network	• Swedish Euraxess web portal launched	(+) Swedish Euraxess webportal launched
	MS27	Action 4: Support the setting up and running of structured innovative doctoral training programmes applying the Principles for Innovative Doctoral Training.	(None)	
	MS28	Action 5: Create an enabling framework for the implementation of the HR Strategy for Researchers incorporating the Charter & Code	(None)	
ERA priority 4: Gender equality and gender mainstreaming in research	MS39	Action 1: Create a legal and policy environment and provide incentives	• No recent developments; Swedish gender equality legislation already strong in international comparison	(–) Signs of insufficient de facto gender equality in public R&D sector due to strong legislation but lack of strong value changes on grass root level
	MS40	Action 2: Engage in partnerships with funding agencies, research organisations and universities to foster cultural and institutional change on gender	(None)	
	MS41	Action 3: Ensure that at least 40% of the under-represented sex participate in committees involved in recruitment/career progression and in	• No recent developments • 2008 autonomy reform does not free universities and HEIs from legal obligation to keep gender balance in evaluation committees	

		establishing and evaluating		
ERA priority 5: Optimal circulation, access to and transfer of scientific knowledge including via digital ERA	MS45	Action 1: Define and coordinate their policies on access to and preservation of scientific information	• 2012 research and innovation bill instructs Swedish Research Council to work out a comprehensive plan for increasing open access publishing throughout the public R&D system	(+) Policy awareness regarding favourability of open access publishing
	MS46	Action 2: Ensure that public research contributes to Open Innovation and foster knowledge transfer between public and private sectors through national knowledge transfer strategies	• 2012 research and innovation bill strongly focused on enhancing academy-industry collaboration, on all levels, including several programs	(+) Focus of research and innovation bill is reassuring (–) Critics point at limited expected effects of efforts in the bill
	MS47	Action 3: Harmonise access and usage policies for research and education-related public e-infrastructures and for associated digital research services enabling consortia of different types of public and private partners	• Launch of SwePub, an open national index of publications, by a consortium of universities and HEIs • Launch of Openaccess.org, a national website promoting open access publishing, by a consortium of universities and HEIs	(–) No legislation (+) Grassroots efforts (by universities and HEIs) appear comparably efficient
	MS48	Action 4: Adopt and implement national strategies for electronic identity for researchers giving them transnational access to digital research services	(None)	

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LIST OF ABBREVIATIONS

BERD	Business Expenditures for Research and Development
BERD	Business Expenditures on R&D
EMU	Economic and Monetary Union
ERF	European Association of National Research Facilities
ESS	European Spallation Source
FAS	Swedish Council for Working Life and Social Research
Formas	Swedish Council for Environment, Agricultural Sciences and Spatial Planning
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Expenditure
GERD	Gross Domestic Expenditure on R&D
HEI	higher education institution
IPC	Innovation Policy Council
IVA	Royal Engineering Sciences Academy
KAW	Knut and Alice Wallenberg Foundation
KVA	Royal Swedish Academy of Sciences
MNC	multinational company
OECD	Organization for Economic Cooperation and Development
R&D	Research and Development
RIS3	Research and Innovation Strategies on Smart Specialisation
RISE	Research Institutes of Sweden
RJ	Bank of Sweden Tercentenary Foundation
RPC	Research Policy Council
SciLifeLab	Science for Life Laboratory
SME	Small or Medium-sized Enterprise
SRA	Strategic Research Areas grants
Vinnova	National Agency for Innovation Systems

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